

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
 United States Patent and Trademark
 Office
 Box PCT
 Washington, D.C. 20231
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 04 August 2000 (04.08.00)	Applicant's or agent's file reference 99P169
International application No. PCT/AU99/01121	Priority date (day/month/year) 18 December 1998 (18.12.98)
International filing date (day/month/year) 17 December 1999 (17.12.99)	
Applicant WINTER, Josef et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:

05 July 2000 (05.07.00)

☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer F. Baechler Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

PCT

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

From the INTERNATIONAL BUREAU

To:

INTELLPRO
Patent and Trade Mark Attorneys
Level 7, Reserve Bank Building
102 Adelaide Street
G.P.O. Box 1339
Brisbane, QLD 4001
AUSTRALIE

Date of mailing (day/month/year) 18 July 2000 (18.07.00)	
Applicant's or agent's file reference 99P169	IMPORTANT NOTIFICATION
International application No. PCT/AU99/01121	International filing date (day/month/year) 17 December 1999 (17.12.99)
International publication date (day/month/year) 29 June 2000 (29.06.00)	Priority date (day/month/year) 18 December 1998 (18.12.98)
Applicant FILTER TECHNOLOGY AUSTRALIA PTY. LIMITED et al	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
3. An **asterisk(*)** appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
4. The **letters "NR"** appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
18 Dec 1998 (18.12.98)	PP 7840	AU	11 Apr 2000 (11.04.00)

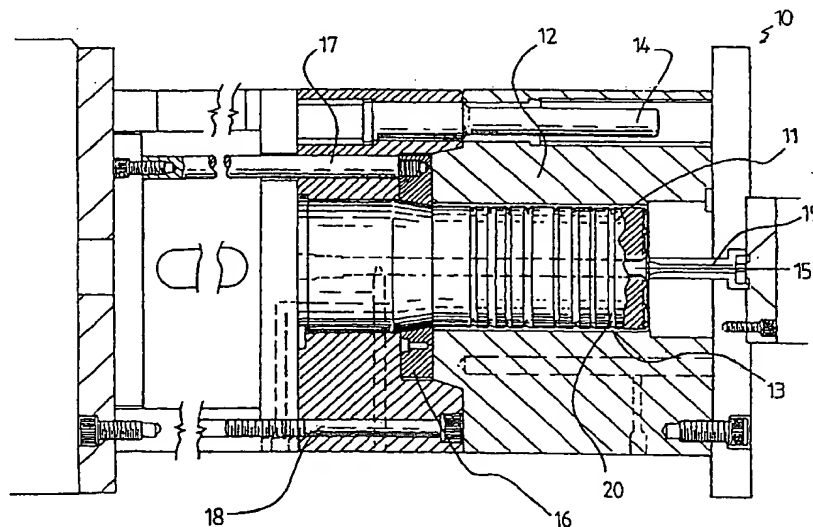
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer Jocelyne Rey-Millet Telephone No. (41-22) 338.83.38
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7: B29C 45/40, B01D 27/08, 35/30		A1	(11) International Publication Number: WO 00/37232
			(43) International Publication Date: 29 June 2000 (29.06.00)
(21) International Application Number: PCT/AU99/01121 (22) International Filing Date: 17 December 1999 (17.12.99) (30) Priority Data: PP 7840 18 December 1998 (18.12.98) AU (71) Applicant (for all designated States except US): FILTER TECHNOLOGY AUSTRALIA PTY. LIMITED [AU/AU]; 133 King Street, Newcastle, NSW 2300 (AU). (72) Inventors; and (75) Inventors/Applicants (for US only): WINTER, Josef [AU/AU]; 114 Koolan Crescent, Shailer Park, QLD 4128 (AU). KRELLE, Harold, Thomas [AU/AU]; 89 Chilton Street, Sunnybank Hills, QLD 4109 (AU). (74) Agent: INTELLPRO; Patent and Trade Mark Attorneys, Level 7, Reserve Bank Building, 102 Adelaide Street, G.P.O. Box 1339, Brisbane, QLD 4001 (AU).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published With international search report.	

(54) Title: A FILTER CARTRIDGE AND PROCESS



(57) Abstract

An injection moulding assembly (10) comprising a male moulding member (11) surrounded by a female moulding member (12) forming a void (13) between them that upon injection of molten plastics into the mould a container can be formed. The moulding assembly includes a guide rod (14) and ejection flange (16) and a pair of ejection flange guide rods (17 and 18), an air vent valve (15) and an injection passage (19). The male member (11) includes in this embodiment eight grooves (20) unevenly spaced so that the partially hardened container formed in the injection mould can be pushed from the mould using the ejection flange (16) while the container is sufficiently green to enable the ribs formed in the grooves (20) to move over the surface of the male mould (11) during the ejection process.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU99/01121**A. CLASSIFICATION OF SUBJECT MATTER**

Int. Cl. B29C 45/40; B01D 27/08, 35/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B29C 45/40; B01D 27/08, 35/30, 27/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC B01D 27/08, 35/30Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT: Green+ OR +CURE+**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AU 27314/92 (650176) B (FRANTZ FILTERS MARKETING PTY. LTD) 29 April 1993, see page 6 lines 9-16 and figures 1-3	4-10, 12-18, 21-25
X	WO 97 19737 A (FILTER TECHNOLOGY INTERNATIONAL PTY. LTD.) 5 June 1997, see pages 3-5 and figures 1-6	4-10, 12-18, 21-25
A	US 5 556 542 A (Berman, et al.) 17 September 1996	

☐ Further documents are listed in the continuation of Box C
 ☒ See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
24 March 2000

Date of mailing of the international search report

29 MAR 2000

Name and mailing address of the ISA/AU

AUSTRALIAN PATENT OFFICE
PO BOX 200, WODEN ACT 2606, AUSTRALIA
E-mail address: pct@ipaustalia.gov.au
Facsimile No. (02) 6285 3929

Authorized officer

JOHN DEUIS
Telephone No : (02) 6283 2146

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU99/01121

Supplemental Box

(To be used when the space in any of Boxes I to VIII is not sufficient)

Continuation of Box No: II

The International application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. In coming to this conclusion the International Searching Authority has found that there are two inventions:

1. Claims 1-3 are directed to a method of construction of internally ribbed injection moulded hollow tube section wherein, the steps of removing the female mould member from the male mould member, and then the removal of the tube from the male mould, both occur while the tube is in a green state. It is considered that the above integers comprise a first "special technical feature".
2. Claim 4-26 is directed to a rigid injection moulded generally cylindrical canister. It is considered that the above integers comprise a second "special technical feature".

Since the above-mentioned groups of claims do not share either technical features identified, a "technical relationship" between the inventions, as defined in PCT Rule 13.2 does not exist. Accordingly the International application does not relate to one invention as a single inventive concept.

INTERNATIONAL COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 99P169	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International application No. PCT/AU99/01121	International filing date (<i>day/month/year</i>) 17 December 1999	Priority Date (<i>day/month/year</i>) 18 December 1998
International Patent Classification (IPC) or national classification and IPC Int. Cl. ⁷ B29C 45/40; B01D 27/08, 35/30		
Applicant FILTER TECHNOLOGY AUSTRALIA PTY LIMITED et al		

1.	This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.																								
2.	This REPORT consists of a total of 4 sheets, including this cover sheet. <input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT). These annexes consist of a total of 4 sheet(s).																								
3. This report contains indications relating to the following items: <table style="width: 100%; margin-top: 10px;"> <tr> <td style="width: 5%;">I</td> <td style="width: 5%;"><input checked="" type="checkbox"/></td> <td>Basis of the report</td> </tr> <tr> <td>II</td> <td><input type="checkbox"/></td> <td>Priority</td> </tr> <tr> <td>III</td> <td><input type="checkbox"/></td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td>IV</td> <td><input type="checkbox"/></td> <td>Lack of unity of invention</td> </tr> <tr> <td>V</td> <td><input checked="" type="checkbox"/></td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td>VI</td> <td><input type="checkbox"/></td> <td>Certain documents cited</td> </tr> <tr> <td>VII</td> <td><input checked="" type="checkbox"/></td> <td>Certain defects in the international application</td> </tr> <tr> <td>VIII</td> <td><input type="checkbox"/></td> <td>Certain observations on the international application</td> </tr> </table>		I	<input checked="" type="checkbox"/>	Basis of the report	II	<input type="checkbox"/>	Priority	III	<input type="checkbox"/>	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	IV	<input type="checkbox"/>	Lack of unity of invention	V	<input checked="" type="checkbox"/>	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	VI	<input type="checkbox"/>	Certain documents cited	VII	<input checked="" type="checkbox"/>	Certain defects in the international application	VIII	<input type="checkbox"/>	Certain observations on the international application
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VII	<input checked="" type="checkbox"/>	Certain defects in the international application																							
VIII	<input type="checkbox"/>	Certain observations on the international application																							

Date of submission of the demand 5 July 2000	Date of completion of the report 26 October 2000
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer JOHN DEUIS Telephone No. (02) 6283 2146

I. Basis of the report

1. With regard to the elements of the international application:*
- ☐ the international application as originally filed.
- ☒ the description, pages 1-9 as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☒ the claims, pages , as originally filed,
pages , as amended (together with any statement) under Article 19,
pages , filed with the demand,
pages 10-13 received on 18 October 2000 with the letter of 18 October 2000
- ☒ the drawings, pages 1/11-11/11 , as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of
2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is:
- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).
3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, was on the basis of the sequence listing:
- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished
4. ☒ The amendments have resulted in the cancellation of:
- ☐ the description, pages
- ☒ the claims, Nos. 26
- ☐ the drawings, sheets/fig.
5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims 1-25	YES
	Claims	NO
Inventive step (IS)	Claims 1-25	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-25	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)

None of the individual citations disclose all the essential features as claimed. Claims 1-25 are novel and involve an inventive step in that they characterise a rigid injection moulded filter canister wherein the canister is formed about a male mould member and includes anti-tracking ribs that project a distance sufficient to enable the canister to be removed from the male mould member during the moulding process while it is still flexible.

The closest art found was:

AU 27314/92 A (FRANTZ FILTERS MARKETING PTY. LTD.) 29 April 1993
WO 9719737 A (FILTER TECHNOLOGY INTERNATIONAL PTY. LTD.) 5 June 1997

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Claim 25 fails to meet the requirements of rule 6.2(a).



PATENT COOPERATION TREATY

WO 00/37232
PCT/AU99/01121

PCT

From the INTERNATIONAL BUREAU

To:

INTELLPRO
Patent and Trade Mark Attorneys
Level 7, Reserve Bank Building
102 Adelaide Street
G.P.O. Box 1339
Brisbane, QLD 4001
AUSTRALIE

NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

Date of mailing (day/month/year) 29 June 2000 (29.06.00)		
Applicant's or agent's file reference 99P169		
IMPORTANT NOTICE		
International application No. PCT/AU99/01121	International filing date (day/month/year) 17 December 1999 (17.12.99)	Priority date (day/month/year) 18 December 1998 (18.12.98)
Applicant FILTER TECHNOLOGY AUSTRALIA PTY. LIMITED et al		

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
AU,CN,JP,KP,KR,US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

AE,AL,AM,AP,AT,AZ,BA,BB,BG,BR,BY,CA,CH,CR,CU,CZ,DE,DK,DM,EA,EE,EP,ES,FI,GB,GD,GE,
GH,GM,HR,HU,ID,IL,IN,IS,KE,KG,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MN,MW,MX,NO,NZ,
OA,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on
29 June 2000 (29.06.00) under No. WO 00/37232

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a **demand for international preliminary examination** must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the **national phase**, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer J. Zahra Telephone No. (41-22) 338.83.38
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PATENT COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY EXAMINATION REPORT

REC'D 07 NOV 2000

WIPO

PCT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 99P169	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International application No. PCT/AU99/01121	International filing date (day/month/year) 17 December 1999	Priority Date (day/month/year) 18 December 1998
International Patent Classification (IPC) or national classification and IPC Int. Cl. ⁷ B29C 45/40; B01D 27/08, 35/30		
Applicant FILTER TECHNOLOGY AUSTRALIA PTY LIMITED et al		

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2. This REPORT consists of a total of **4** sheets, including this cover sheet.
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 These annexes consist of a total of **4** sheet(s).

3. This report contains indications relating to the following items:

- | | | |
|------|-------------------------------------|---|
| I | <input checked="" type="checkbox"/> | Basis of the report |
| II | <input type="checkbox"/> | Priority |
| III | <input type="checkbox"/> | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| IV | <input type="checkbox"/> | Lack of unity of invention |
| V | <input checked="" type="checkbox"/> | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| VI | <input type="checkbox"/> | Certain documents cited |
| VII | <input checked="" type="checkbox"/> | Certain defects in the international application |
| VIII | <input type="checkbox"/> | Certain observations on the international application |

Date of submission of the demand 5 July 2000	Date of completion of the report 26 October 2000
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer JOHN DEUIS Telephone No. (02) 6283 2146

I. Basis of the report

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- ☒ the claims, pages , as originally filed,
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pages 10-13 received on 18 October 2000 with the letter of 18 October 2000
- ☒ the drawings, pages 1/11-11/11 , as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of
2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
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- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
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** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims 1-25	YES
	Claims	NO
Inventive step (IS)	Claims 1-25	YES
	Claims	NO
Industrial applicability (IA)	Claims 1-25	YES
	Claims	NO

2. Citations and explanations (Rule 70.7)

None of the individual citations disclose all the essential features as claimed. Claims 1-25 are novel and involve an inventive step in that they characterise a rigid injection moulded filter canister wherein the canister is formed about a male mould member and includes anti-tracking ribs that project a distance sufficient to enable the canister to be removed from the male mould member during the moulding process while it is still flexible.

The closest art found was:

AU 27314/92 A (FRANTZ FILTERS MARKETING PTY. LTD.) 29 April 1993
WO 9719737 A (FILTER TECHNOLOGY INTERNATIONAL PTY. LTD.) 5 June 1997

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Claim 25 fails to meet the requirements of rule 6.2(a).

CLAIMS

1. A method of construction of internally ribbed injection moulded hollow tube sections suitable for use in a filter element holding a paper roll filter media, the method comprising steps of:

5 (i) providing a generally cylindrical male mould member having longitudinally spaced rib defining grooves and a free end;

(ii) providing a female mould member adapted to overlay the male mould member in closely spaced relation defining a tube shaped void between the mould members;

10 (iii) injecting moulding material into the void, said moulding material being selected to provide a substantially rigid tube when cured;

(iv) removing the female mould member from the male mould member while the tube is in a green state, the grooves in the male mould member retaining the tube in position on the male mould member; and

15 (v) subsequently forcing the tube from the male mould member while the tube is still in a green state.

2. A method according to claim 1 wherein the grooves are not uniformly spaced on the male mould member so that once the initial release of the tube from all of the grooves takes place, as the tube is progressively slid off the male mould
20 member, the ribs do not all encounter grooves at the same time.

3. A method according to claim 1 or claim 2 wherein the tube shaped void includes a void forming a transverse base across one end of the tube at the free end of the male mould member, during production while the moulding material covers the free end of the male mould member, the inside of the base is vented through
25 the male mould member to avoid suction that may inhibit pushing of the tube off the male mould member.

4. A rigid injection moulded generally cylindrical canister formed about a male mould member, the canister having a side wall, the side wall having an outer surface and an inner surface, the canister being used as a filter element holding a
30 paper roll as filter media, the canister having a thin side wall and there being spaced anti-tracking ribs projecting from the inner surface of the side wall and

projecting a distance sufficient to enable the canister to be removed from the male mould member during a moulding process and while still sufficiently flexible, the paper roll being of marginally greater diameter than the internal diameter of the canister, the canister being sufficiently rigid and the paper roll being sufficiently tightly wound that the paper roll, when inserted into the canister using a press, is substantially compressed to the internal dimension of the canister without distortion of the canister.

5 5. A rigid injection moulded canister according to claim 4 wherein the ribs project at 1 mm to 2 mm from the inner surface of the canister.

10 6. A rigid injection moulded canister according to claim 4 wherein the ribs project about 1.5 mm from the inner surface of the canister.

7. The canister according to claim 4 wherein the ribs are evenly spaced, the inner wall having slight taper on the inner surface to enable release from the male mould.

15 8. The canister according to claim 4 including a marginal taper on the inner surface at the open end to act as a lead-in for the paper roll.

9. The canister according to claim 4 including a base and wherein the base is inwardly biased.

20 10. The canister according to claim 4 including a base and wherein the base is inwardly dished at the centre relative to the edges in order to provide a bias against loading as a paper roll is being pressed into the canister.

25 11. The canister according to claim 4 including a base and wherein the base has an inner surface with radially extending flow passages separated by lands, the lands defining a supporting surface to evenly distribute and support the paper roll media across the base of the canister to provide secondary flow passages across the base of the canister.

30 12. A filter element having a rigid injection moulded generally cylindrical canister formed about a male mould member, the canister having a side wall, the side wall having an outer surface and an inner surface, the canister holding a paper roll as filter media, the canister having a thin side wall and there being spaced anti-tracking ribs projecting from the inner surface of the side wall and projecting

a distance sufficient to enable the canister to be removed from the male mould member during a moulding process and while still sufficiently flexible, the paper roll being of marginally greater diameter than the internal diameter of the canister, the canister being sufficiently rigid and the paper roll being sufficiently tightly wound that the paper roll, when inserted into the canister using a press, is substantially compressed to the internal dimension of the canister without distortion of the canister.

13. A filter element according to claim 12 wherein the ribs project at 1 mm to 2 mm from the inner surface of the canister.

10 14. A filter element according to claim 12 wherein the ribs project about 1.5 mm from the inner surface of the canister.

15. A filter element according to claim 12 wherein the ribs are evenly spaced, the inner wall having slight taper on the inner surface to enable release from the male mould.

15 16. A filter element according to claim 12 including a marginal taper on the inner surface at the open end to act as a lead-in for the paper roll.

17. A filter element according to claim 12 including a base and wherein the base is inwardly biased.

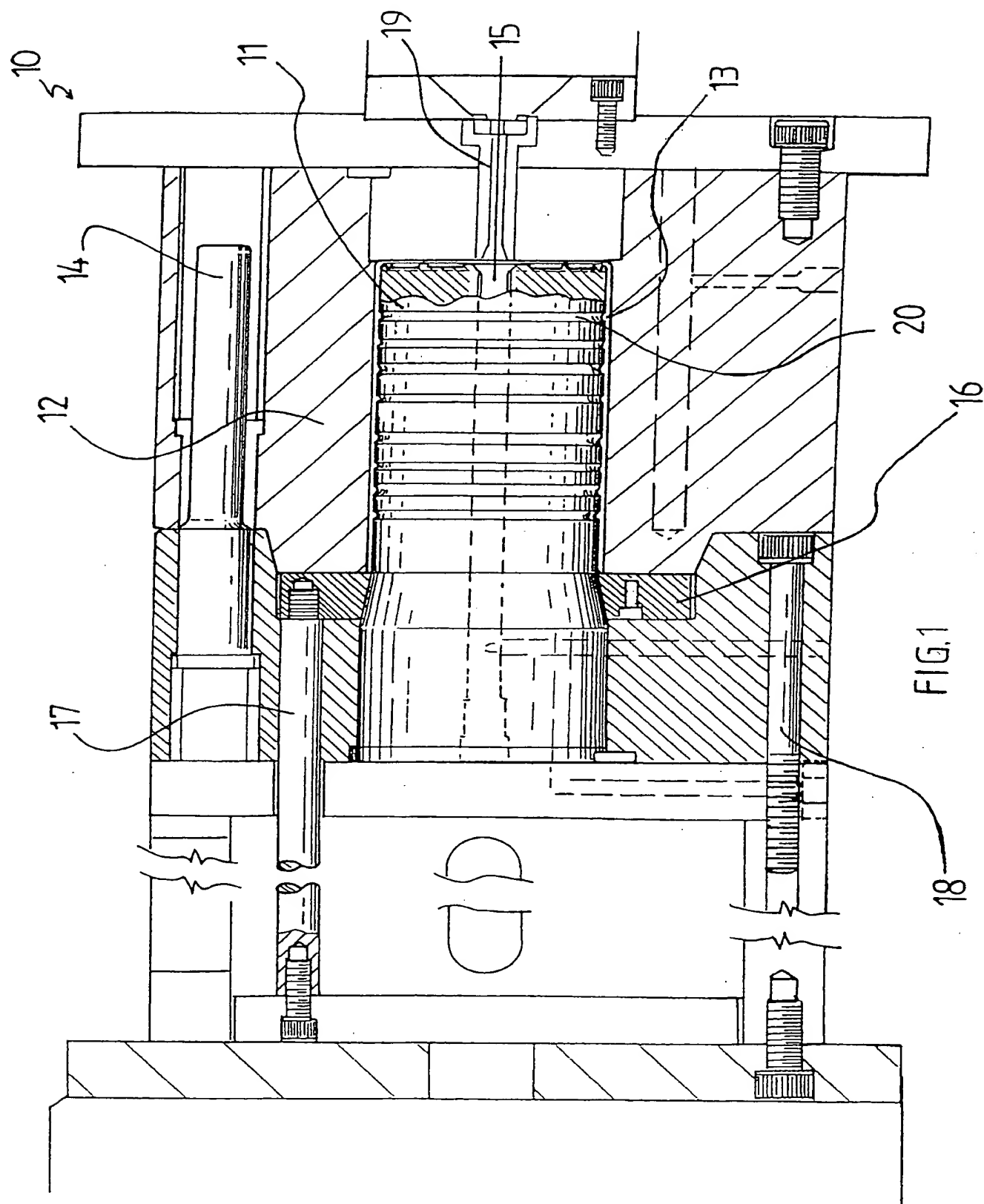
18. A filter element according to claim 12 including a base and wherein the base is inwardly dished at the centre relative to the edges in order to provide a bias against loading as a paper roll is being pressed into the canister.

19. A filter element according to claim 12 including a base and wherein the base has an inner surface with radially extending flow passages separated by lands, the lands defining a supporting surface to evenly distribute and support the paper roll media across the base of the canister to provide secondary flow passages across the base of the canister.

20. A filter element according to claim 12 wherein the paper roll is wound to an average density of about 13m/radial cm.

21. A filter element according to claim 12 wherein the paper roll is wound to an average density of no less than about 11m/radial cm and no more than about 15m/radial cm.

22. A filter element according to claim 12 wherein the paper roll is wound to an average density of about 13m/radial cm.
23. A filter element according to claim 12 wherein the paper roll is wound to an average density of about 13m/radial cm and the paper thickness is about 17gsm.
- 5 24. A filter element according to claim 12 wherein the paper roll is wound to an average density of no less than about 11m/radial cm and no more than about 15m/radial cm and the paper thickness is about 17gsm.
25. A filter canister substantially as described with references to the accompanying drawings.



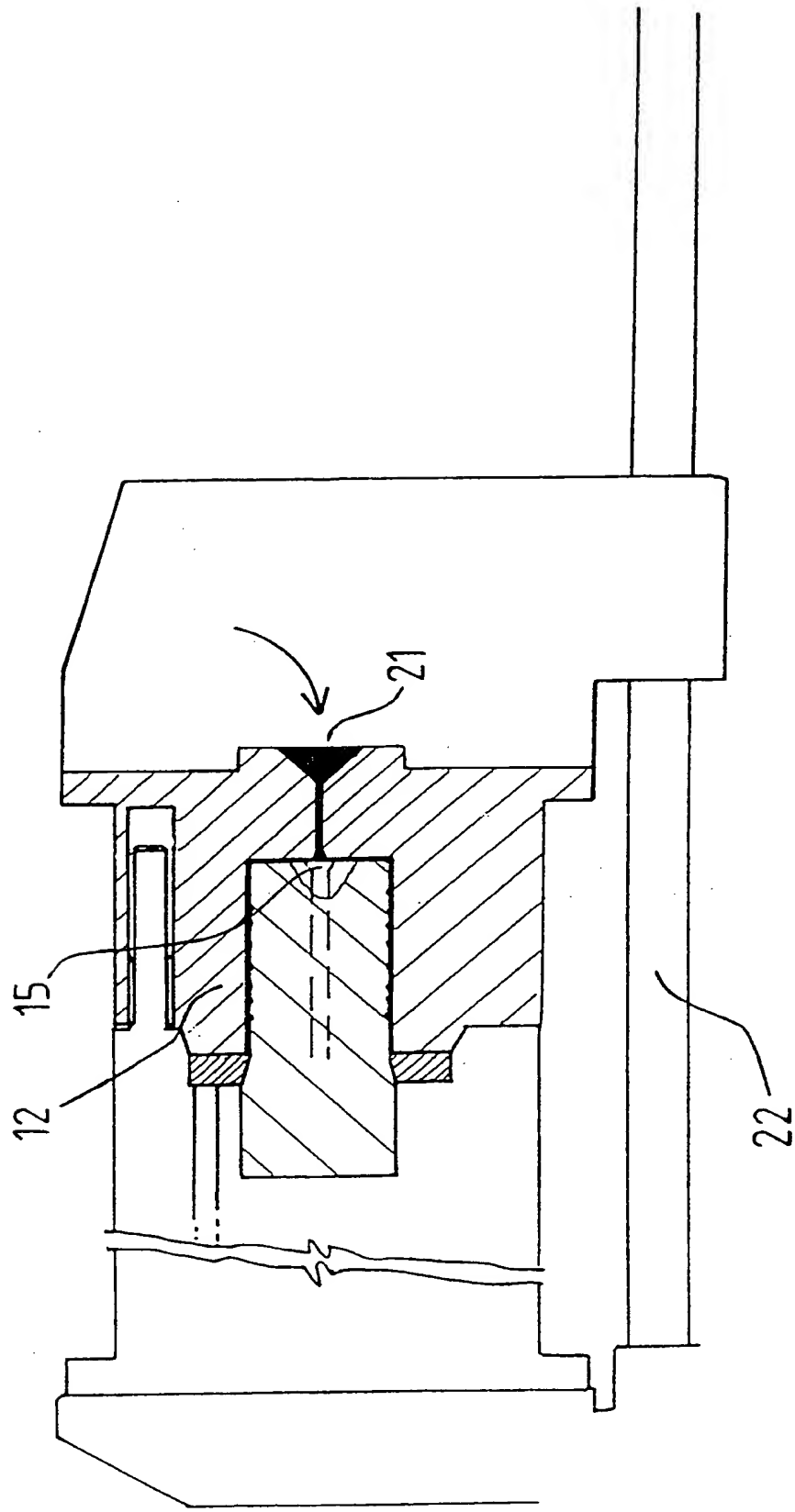


FIG.2

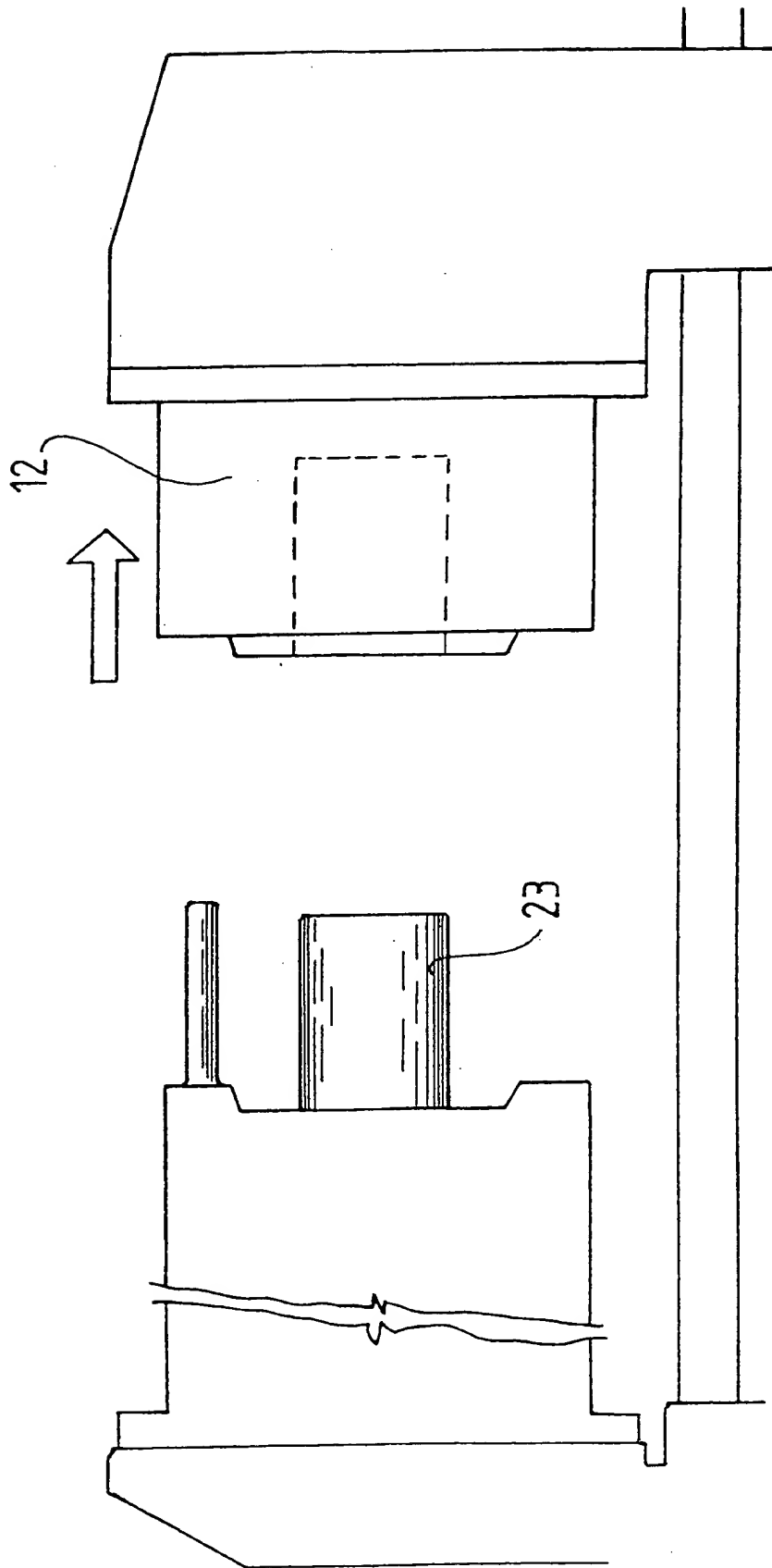
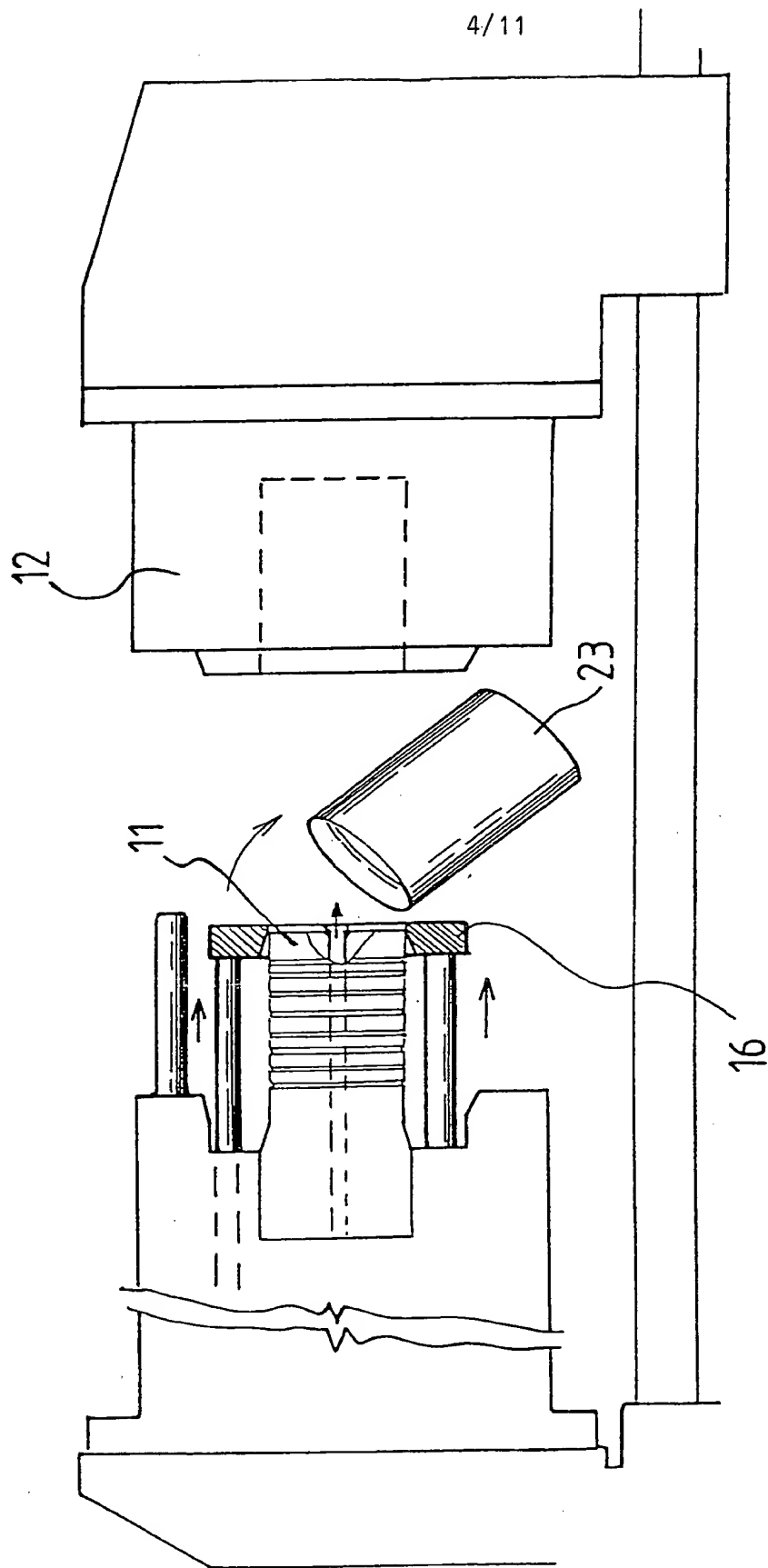


FIG.3



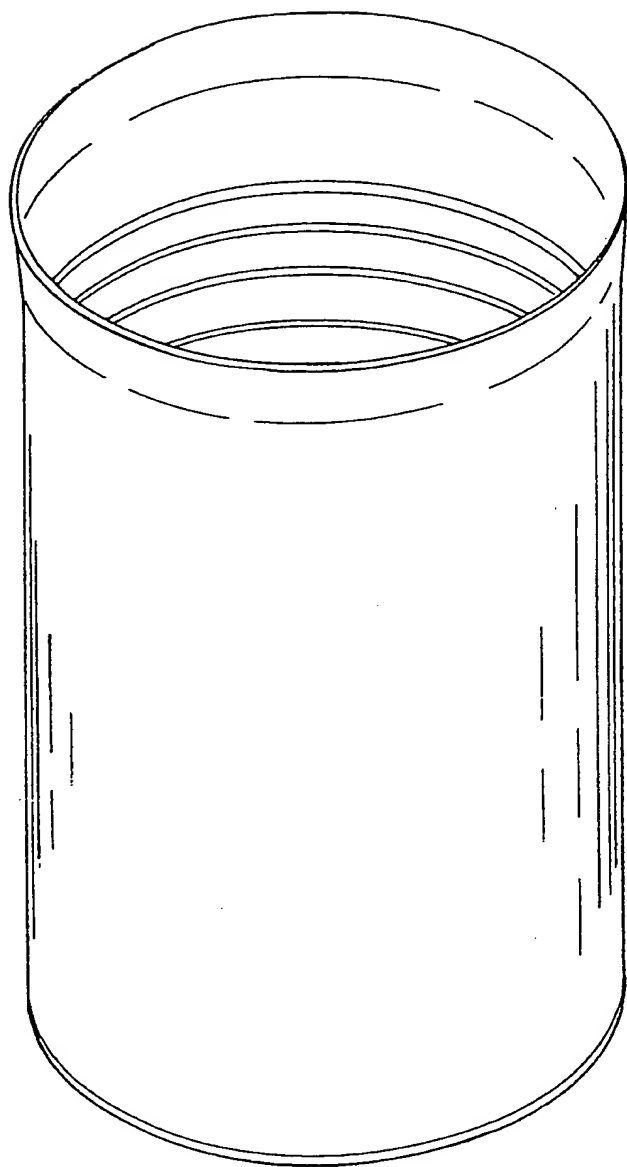


FIG. 5

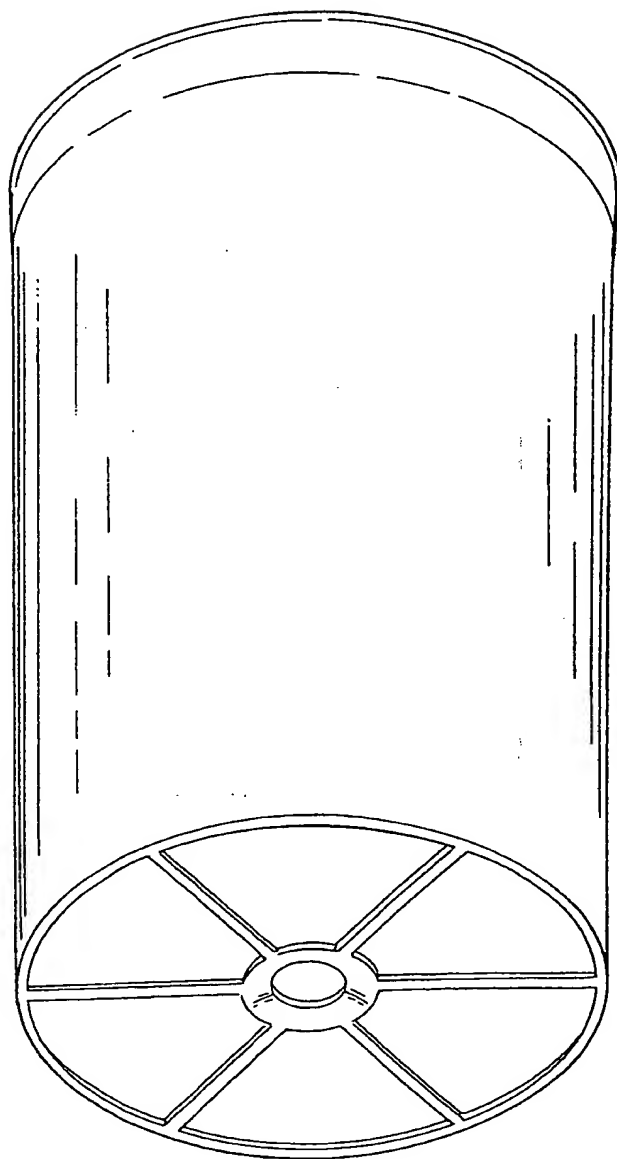


FIG. 6

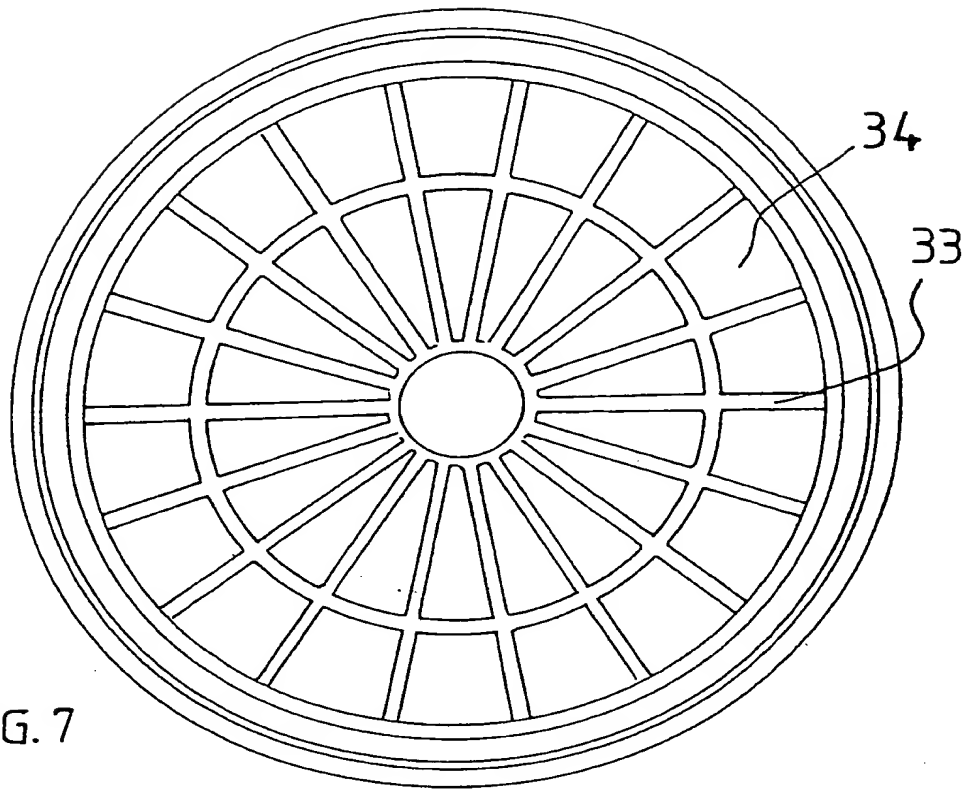


FIG. 7

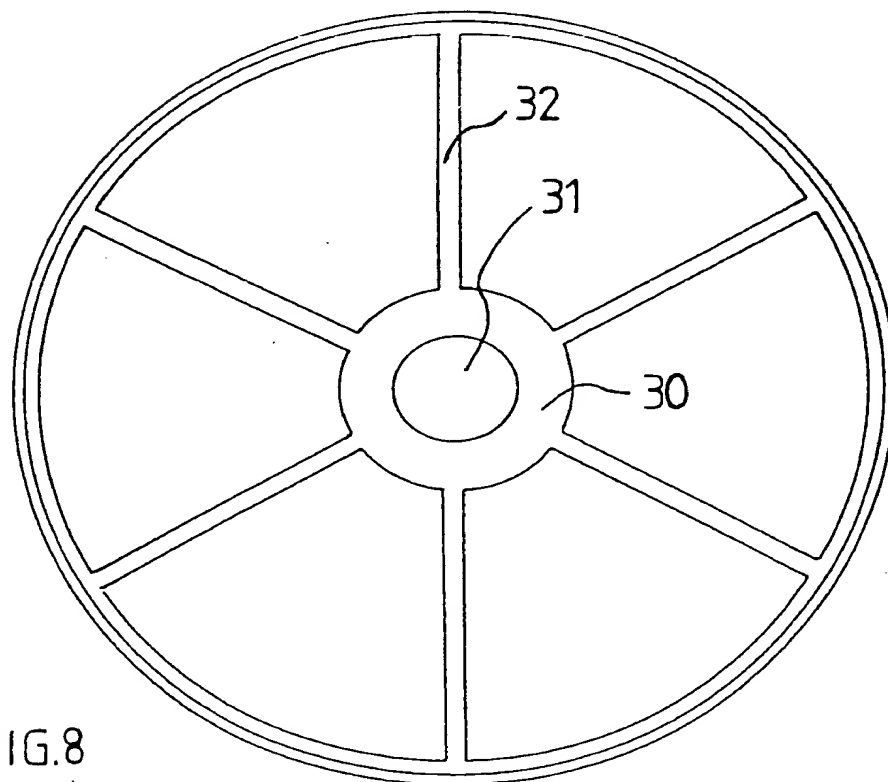


FIG. 8

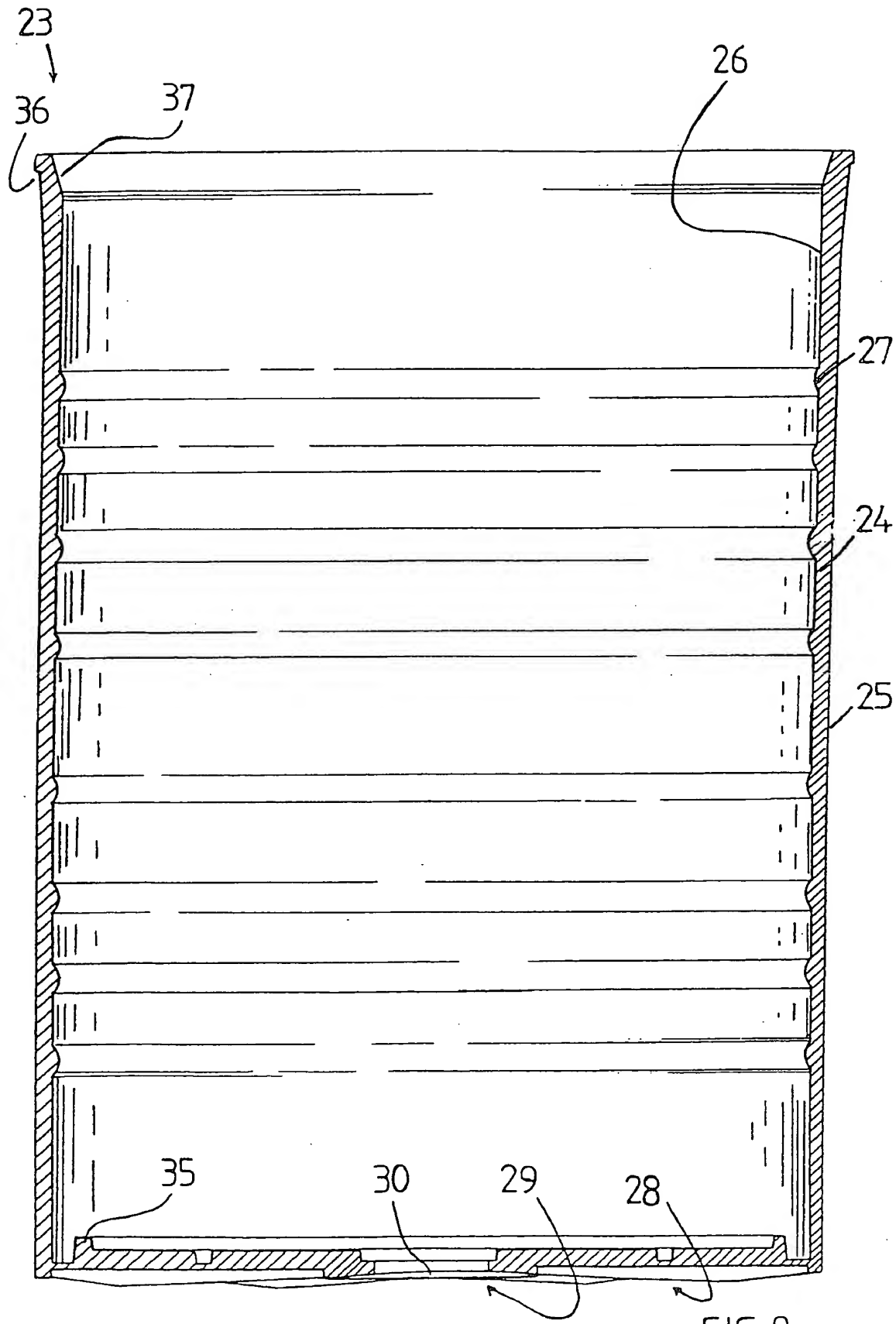
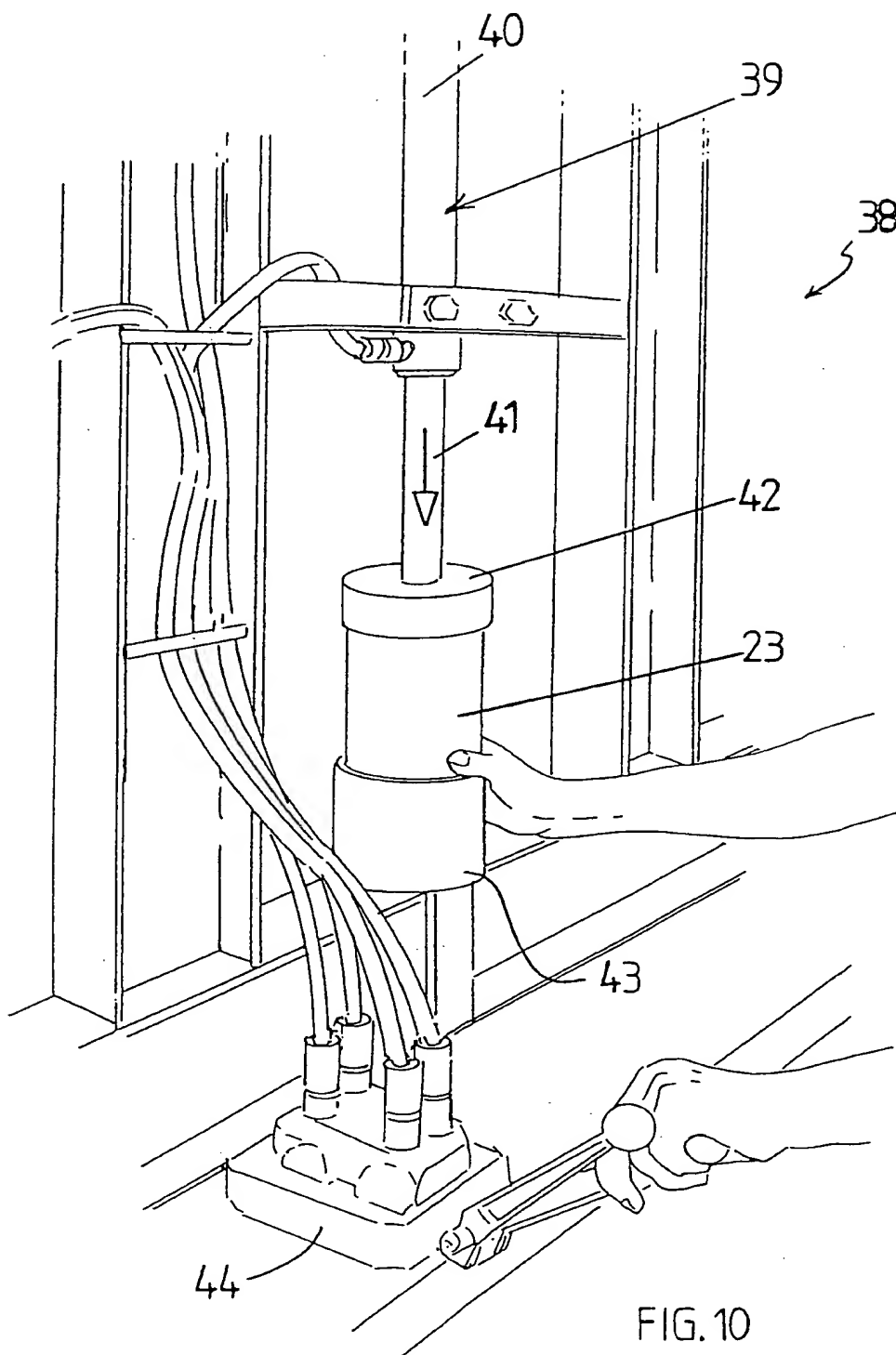
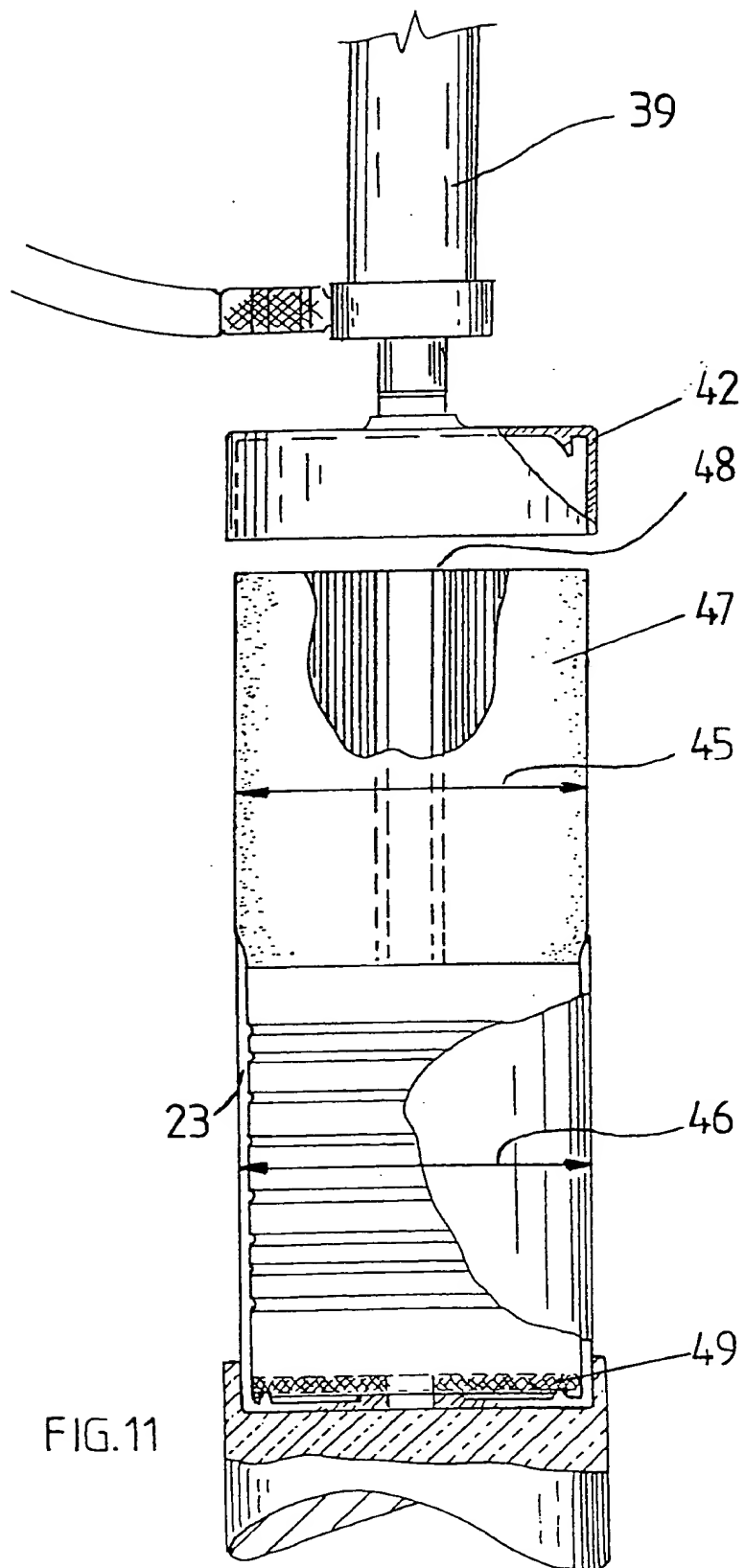


FIG. 9





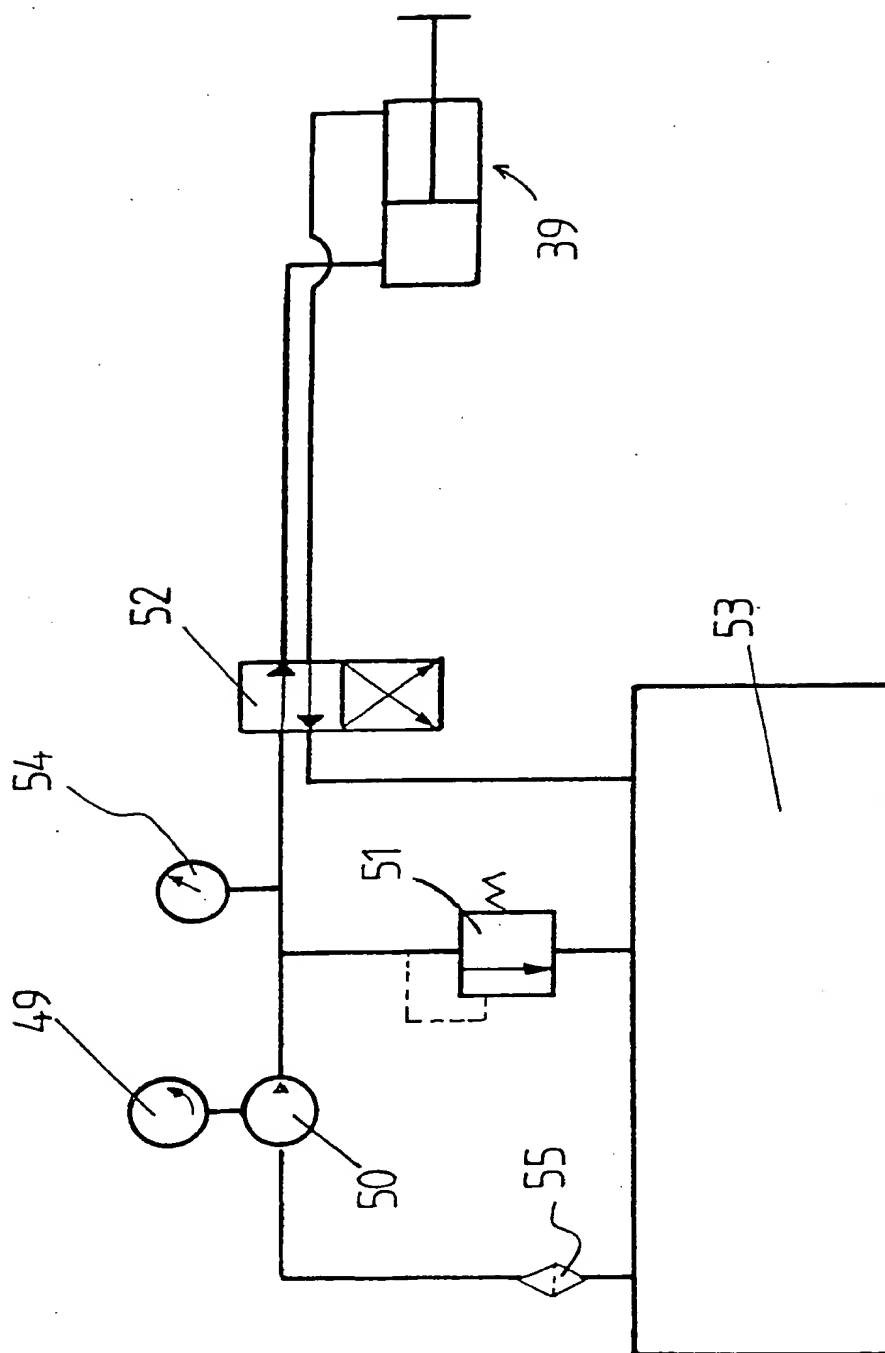


FIG.12

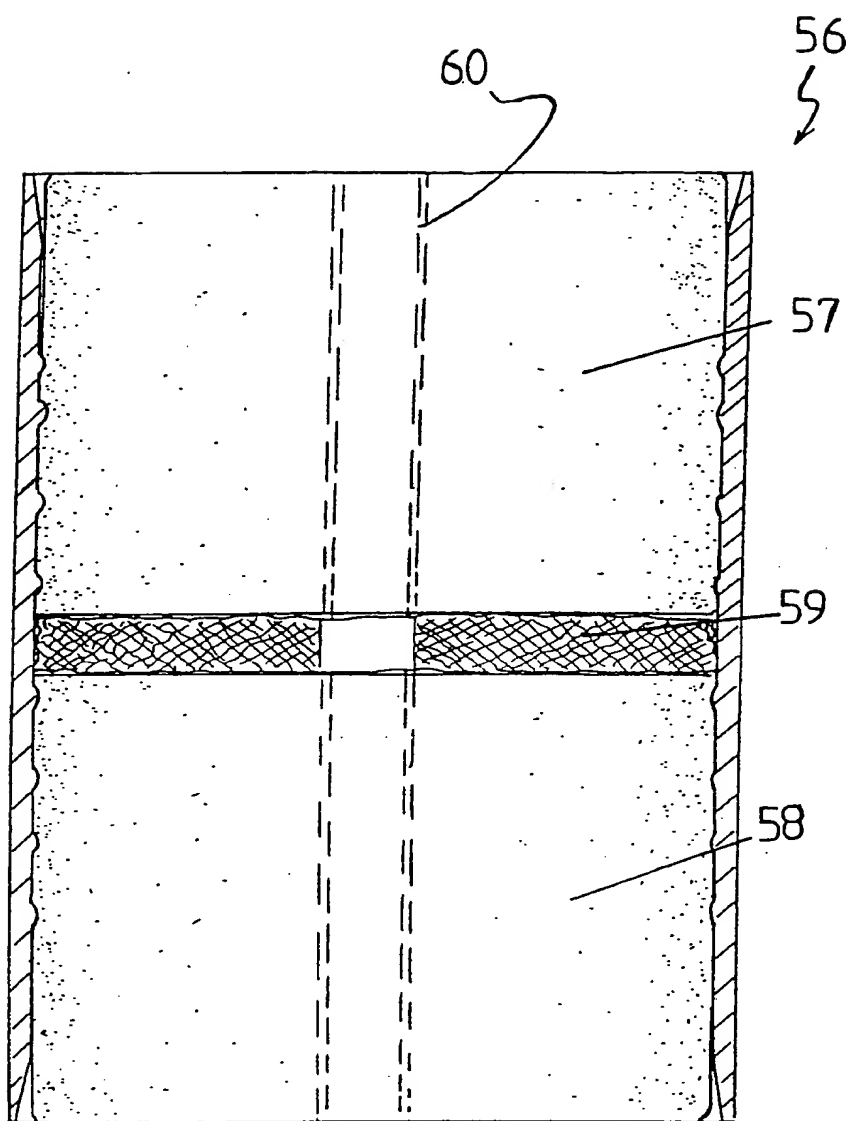


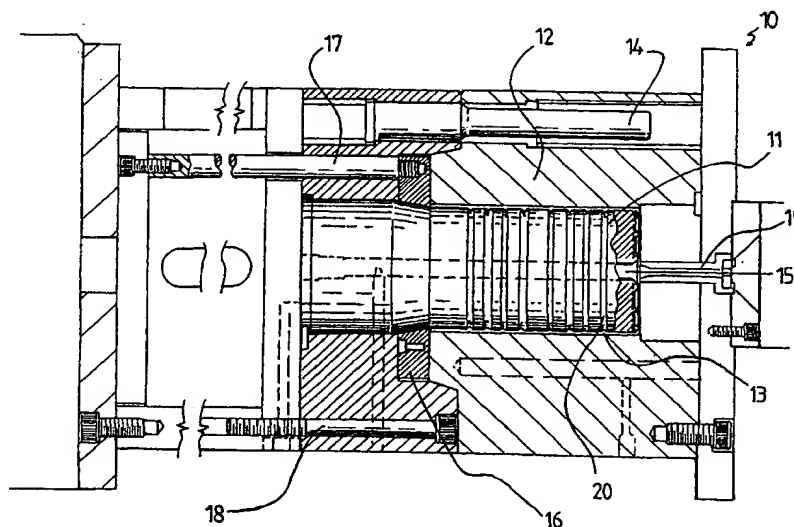
FIG. 13



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(21) International Application Number: PCT/AU99/01121 (22) International Filing Date: 17 December 1999 (17.12.99) (30) Priority Data: PP 7840 18 December 1998 (18.12.98) AU (71) Applicant (for all designated States except US): FILTER TECHNOLOGY AUSTRALIA PTY. LIMITED [AU/AU]; 133 King Street, Newcastle, NSW 2300 (AU). (72) Inventors; and (75) Inventors/Applicants (for US only): WINTER, Josef [AU/AU]; 114 Koolan Crescent, Shailer Park, QLD 4128 (AU). KRELLE, Harold, Thomas [AU/AU]; 89 Chilton Street, Sunnybank Hills, QLD 4109 (AU). (74) Agent: INTELLPRO; Patent and Trade Mark Attorneys, Level 7, Reserve Bank Building, 102 Adelaide Street, G.P.O. Box 1339, Brisbane, QLD 4001 (AU).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>

(54) Title: A FILTER CARTRIDGE AND PROCESS



(57) Abstract

An injection moulding assembly (10) comprising a male moulding member (11) surrounded by a female moulding member (12) forming a void (13) between them that upon injection of molten plastics into the mould a container can be formed. The moulding assembly includes a guide rod (14) and ejection flange (16) and a pair of ejection flange guide rods (17 and 18), an air vent valve (15) and an injection passage (19). The male member (11) includes in this embodiment eight grooves (20) unevenly spaced so that the partially hardened container formed in the injection mould can be pushed from the mould using the ejection flange (16) while the container is sufficiently green to enable the ribs formed in the grooves (20) to move over the surface of the male mould (11) during the ejection process.

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A FILTER CARTRIDGE AND PROCESS

FIELD OF THE INVENTION

THIS INVENTION relates to filtration and in particular but not limited to filtration of engine, transmission and hydraulic oils, fuel and solvents.

5

BACKGROUND ART

Oil filtration involves the use of full flow filters that filter all oil on every pass through the filter and the use of by-pass oil filters in conjunction with the full flow filters. By-pass oil filters operate in parallel with the full flow filter and generally speaking have a greater filtration than the full flow filter.

10

Full flow elements filter all oil on every pass and work using an element operating like a series of small sieves, with tiny holes allowing oil to pass through, while filtering out particles too large to pass through the sieve-like element. However, the holes are not small enough to filter out many finer particles, and it is these particles that can cause significant engine wear over a period of time.

15

On the other hand a by-pass filter operates in parallel with the full flow filter and can be much finer to progressively remove finer contaminants not captured by the full flow filter. The use of a by-pass filter progressively filters all the oil, thus increasing the useful life of the oil and reducing engine wear.

20

Typical by-pass oil filters include pleated element by-pass elements. These filters employ a longitudinally pleated membrane that is prone to become clogged after just a few hours work. Many by-pass filters have a pressure release valve that opens when this occurs. Another type of by-pass filter is a multiple disc by-pass filter which lasts much longer than the pleated elements.

25

The most effective by-pass filters employ a roll of paper wound on a central core with the feedstock being forced edgewise through the roll of paper to progress longitudinally the full width of the paper media. The filtrate then flows to the central core where it exits the filter via a return pipe. The principle of operation of this type of filter is different to the sieve-like filter and the pleated filter in so far as the paper roll filter relies on oil passing between the layers of paper, instead of

30

passing through a sieve-like element.

Early forms of paper roll filters employed a toilet roll fitted within a filter housing. Later more sophisticated forms employed a filter element comprising a disposable canister holding the paper roll.

5 Australian patent number 650176 describes a filter element of the cartridge type employing a filter housing with a filter element within the housing. The filter element employs a metal canister with a paper roll forced into the canister under pressure, the canister being open at one end, for entry of feedstock, with a base at the other end, the base having a central hole for the return pipe. A layer of gauze in the base of the canister allows the filtrate to flow across the base to the return
10 pipe in the central core. The sides of the canister are ribbed to inhibit feed stock tracking down the sides of the canister. The canister also has three or four depressions circumferentially spaced depressions in the base to hold the gauze layer away from the base providing clear secondary flow passages below the gauze to improve flow of filtrate.

15 The paper is tightly wound providing a much finer effective filter than the pleated and disc type filters.

Nevertheless the metal canister has a number of disadvantages. The ribbed side wall is employed to inhibit tracking of feedstock down the side wall outside the filter media but limits the density of the media. While ribbing is effective to
20 limit tracking the canister is prone to buckle under load while the paper is being pressed into the canister. This effectively limits the amount of sideways compression that can be applied to the paper roll to a maximum defined by the flex in the side walls of the can and the inherent flexing of the ribs as the paper is being pushed into position, the limit being canister failure.

25 The element construction of Australian patent number 650176 results in a five percent (5%) failure rate of canisters during insertion of the paper roll into the canisters. Also the canisters are prone to be crushed by oil pressure when in use particularly at cold start up when the oil is most viscous. Construction of canisters from thicker metal would make filters more expensive and the ribbing to prevent
30 tracking more difficult to produce in a technical sense.

Since the metal canisters are disposable they must be designed for single use application at a reasonably economical cost. It would be desirable to provide an alternative that is competitively priced, improves filtration and is less likely to buckle under load.

5 As an alternative to metal canisters PCT/AU96/00762 describes a plastics filter canister suitable for repeated use to enable recycling of the canister. The canister is made sufficiently rigid such that the spent paper roll can be removed using a tool and a fresh roll inserted into the canister. Due to the construction of the metal canisters of patent number 650176 efforts to remove the spent rolls from
10 the metal canisters would in most cases render the metal canisters unusable having been designed for use as a disposable element. The problem with the canister described in PCT/AU96/00762 is that the design is not amenable to mass production using injection moulding techniques. In addition, the base of the canister was designed with closely spaced concentric rings in an effort to reproduce
15 the effect of the secondary flow through passages utilised in the base of the metal canister while supporting the media. While this arrangement was effective in supporting the filter media and gauze the flow characteristics were less than desirable.

OUTLINE OF THE INVENTION

20 The present invention achieves its objectives to provide an improved disposable or reusable canister by providing a rigid plastics canister holding a roll of filter paper under higher sideways compression than known in the prior art while enabling manufacture of the filter canister as a one piece injection moulded canister.

25 In one aspect therefore the present invention resides in a method for construction of an internally ribbed injection moulded hollow tube section suitable for use in a filter element holding a paper roll filter media, the method comprising the steps of:

30 (i) providing a generally cylindrical male mould member having longitudinally spaced rib defining grooves;

(ii) providing a female mould member adapted to overlay the male mould member in closely spaced relation defining a tube shaped void between the mould members;

5 (iii) injecting moulding material into the void, said moulding material being selected to provide a substantially rigid tube when cured;

(iv) removing the female mould member from the male mould member while the tube is in a green state, the grooves in the male mould member retaining the tube in position on the male mould member; and

10 (v) subsequently forcing the tube from the male mould member while the tube is still in a green state.

The term "green state" is used herein to mean a condition of hardening whereby the dimensions of the grooves and the degree of hardening of the tube is such that the moulded tube ribs can be pushed from the grooves in the male member without significant distortion of the tube compared to a higher degree of
15 hardening whereby the grooves serve to retain the tube on the male member.

The timing of the release of the tube from the male member will depend upon the nature and characteristics of the plastics moulding material used.

It is desirable that the grooves are not uniformly spaced on the male member so that once the initial release of the tube from all the grooves at the first instance
20 takes place as the tube is slid over the male member, the ribs do not all encounter grooves at the same time. Thus, due to the selected uneven spacing of the grooves, the force required to push the tube over the grooves is restricted such that as the tube is pushed off less than the full complement of ribs engage the grooves at any one time during the process whereby the tube is pushed from the male member.

25 The tube can be open ended or can have one end closed. The tube typically has open ends when it is intended to form an outer casing for a double ended filter such as a fuel filter.

Where the mould includes a void at the free end of the male member for forming a transverse base across one end of the tube, during production and while
30 the moulding material covers the free end of the male member it is preferable to

vent the inside of the base through the male member to avoid suction that may inhibit the pushing of the tube off the male member.

In another aspect the invention resides in a rigid injection moulded generally cylindrical canister, the canister having a side wall, the side wall having an outer surface and an inner surface, the canister being used as a filter element holding a paper roll as filter media, the canister having a thin side wall and there being spaced anti-tracking ribs projecting from the inner surface of the side wall and projecting a distance sufficient to enable the canister to be removed from a male mould member defining said ribs, the paper roll being of marginally greater diameter than the internal diameter of the canister, the canister being sufficiently rigid and the paper roll being sufficiently tightly wound that the paper roll when inserted into the canister using a press is substantially compressed to the internal dimensions of the canister without distortion of the canister.

Typically, the assembled filter element is employed in a standard filter housing where the external dimensions of the element is about 110mm in diameter and 170mm long, the applicant has found that using 17gsm thick paper and paper a paper density above about 15m/cm radial width reduces flow to undesirable levels whereas densities of about 13m/cm radial width is optimum for maximising filtration but at the same time maintaining desirable flow rates, densities below about 11m/cm radial width the roll tends to collapse within the canister base flow can become blocked and the anti-tracking ribs become ineffective. Although filters do work for a short time at these lower densities effective and reliable filtration generally occurs above about 12m/radial cm. The present invention in this preferred form enables just the right amount of paper, matched to the rib size and most desirable compression suited to injection moulding and reliable in operation when compared to the prior art.

Preferably the side walls of the canister include marginal flaring of at least one end of the canister so that the side wall of the canister is medially biased of the order of .5 to 1 millimetre so that the side wall of the canister is biased inwardly to resist distortion of the side wall and enhance compression of the paper roll inside

the canister. Typically the flared end is the open end at which the paper roll is pushed into the canister.

Preferably the ribs project 1 millimetre to 2 millimetres from the inner surface of the canister with 1.5 millimetres being optimum. Where the ribs are evenly spaced it is preferable that they be at the shallower end of the range of projection, the inner wall may have a slight taper on the inner surface to further assist release from the male mould. However, the paper must be more tightly wound and placed under higher compression to achieve the same filter efficiency and anti-tracking when compared to a cylindrical shape where the inner diameter is uniform or carries the medially biased inward shape.

The canister preferably includes a marginal taper on the inner surface at the open end to act as a lead in for the paper roll, the objective being to minimise the "give" in the canister and to maximise the sideways compression applied to the shallow anti-tracking ribs.

Preferably where the canister has a base, the base includes external radial strengthening ribs and again is biased inwardly. The base is typically inwardly dished by up to 2 millimetres at the centre relative to the edges in order to provide a bias against the loading of the paper roll as the paper roll is being pressed home into the canister.

The base preferably has an inner surface with radially extending flow passages separated by lands, the lands defining supporting surfaces for a gauze to evenly distribute and support the paper roll media across the base of the canister and to provide secondary flow passages across the base of the canister below the gauze.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the present invention can be more readily understood and be put into practical effect reference will now be made to the accompanying drawings which illustrate preferred embodiments of the invention and wherein:

Figure 1 is a drawing illustrating an injection moulding apparatus for implementing the method described;

Figures 2, 3 and 4 are schematic drawings illustrating the moulding process utilising the apparatus of Figure 1;

Figures 5 and 6 are opposite perspective views; Figure 7 is a top view; Figure 8 is a bottom view; and Figure 9 is a cross-section all illustrating a canister made using the apparatus of Figure 1;

Figure 10 is a perspective drawing illustrating a hydraulic press used to push a paper roll into the canister of Figures 5 to 9;

Figure 11 is a schematic drawing illustrating operation of the press and the assembly of an oil filter element;

Figure 12 is a schematic drawing of the hydraulic circuit for the press; and Figure 13 is a section through a fuel filter element.

METHOD OF PERFORMANCE

Referring to the drawings and initially to Figure 1 there is illustrated an injection moulding assembly 10 comprising a male moulding member 11 surrounded by a female moulding member 12 forming a void 13 between them that upon injection of molten plastics into the mould a container can be formed. The moulding assembly includes a guide rod 14 and ejection flange 16 and a pair of ejection flange guide rods 17 and 18, an air vent valve 15 and an injection passage 19. The male member 11 includes in this embodiment eight grooves 20 unevenly spaced so that the partially hardened container formed in the injection mould can be pushed from the mould using the ejection flange 16 while the container is sufficiently green to enable the ribs formed in the grooves 20 to move over the surface of the male mould 11 during the ejection process.

Figures 2, 3 and 4 illustrate the three stages of production of a container using the injecting moulding assembly of Figure 1. Figure 2 represents the first stage in the process whereby liquid plastic is forced in under pressure and is represented as the black section at 21. An air vent valve at 15 is closed and the female moulding member 12 is in the closed position along the main guide rails 22.

In stage 2 represented by Figure 3 the female mould member 12 has been withdrawn while the container 23 remains on the male moulding member. The container 23 is still green at this stage. In the third stage of the process the ejection

flange 16 is driven along the surface of the male mould member and the air vent valving is opened and the container 23 is pushed off the male moulding member 11 as illustrated in Figure 4.

A typical container formed using the apparatus of Figure 1 is illustrated in
5 Figures 5 to 9. The container is a generally cylindrical canister having a side wall 24, the side wall having an outer surface 25 and an inner surface 26, the canister being used as a filter element holding a paper roll as filter media, the canister has a thin side wall and includes spaced anti-tracking ribs 27 that project in this case 1.5 millimetres into the interior of the container. The base 28 is inwardly dished
10 at 29 and also includes a curved seat 30 for a sealing washer, a single aperture 31 being provided for a return tube for returning the filtrate from the filter to the main oil or fuel circuit. The base is externally ribbed with strengthening ribs 32 while the interior of the base includes radial flow passages 33 separated by lands 34. As can be seen there are in this embodiment 18 flow passages 33 and an annular
15 projection 35. The annular projection 35 also serves an anti-tracking purpose in so far as any small amounts of oil that begin to track down the sides of the container become trapped in the annular channel 36 around the base 28 of the canister. The container 23 includes a flared marginal edge region at 36 and an outward chamfer at 37 which operates as a lead in for the paper roll into the canister 23.

20 Figure 10 illustrates the operation of a press 38 employing a hydraulic ram 39 having a cylinder assembly 40 with a piston rod 41 and a platen 42 and a base platen 43 with a control valve 44.

Assembly of a filter element is illustrated in Figure 11. The diameters illustrated with the arrows 45 and 46 are approximately the same with the paper
25 roll 47 comprising approximately 43 metres of paper wound into a tight 110 millimetre to 114 millimetre diameter roll on a cardboard core.

A layer of gauze 49 is placed in the base of the canister 23, the paper is initially pushed into position by hand as illustrated in Figure 11 and then the guiding platen 42 is placed down onto the paper roll, activation of the hydraulic
30 cylinder assembly causes the paper roll to be pushed into the canister 23.

The press used to force the paper roll into the canister in one typical embodiment is a 50 millimetre diameter hydraulic cylinder assembly 39. A one horse power single phase electric motor drives a 20 litre per minute gear pump 50. The cylinder operating pressure is 70 to 80 pounds per square inch which is achieved through an in-built adjustable relief valve 51. The relief valve is situated at the directional spool valve that the operator uses to operate the cylinder 52.

Other elements illustrated in the hydraulic circuit is the hydraulic reservoir 53 and a pressure valve 54 and a filter 55.

The last drawing illustrates application of the present invention to a fuel filter element 56 which can be made using the apparatus of Figure 1 simply by adjusting the thickness of the base to be very thin so that the base can be removed making an open ended tube. Fuel to be filtered flows into the tube from both ends. Two half size paper rolls are inserted with a return flow path provided by an intermediate gauze. A return tube is located in the central core as in the previous embodiment.

Whilst the above has been given by way of illustrative example of the present invention many variations and modifications thereto will be apparent to those skilled in the art without departing from the broad ambit and scope of the invention as herein set out in the appended claims.

CLAIMS

1. A method of construction of internally ribbed injection moulded hollow tube sections suitable for use in a filter element holding a paper roll filter media, the method comprising steps of:
- 5 (i) providing a generally cylindrical male mould member having longitudinally spaced rib defining grooves and a free end;
- (ii) providing a female mould member adapted to overlay the male mould member in closely spaced relation defining a tube shaped void between the mould members;
- 10 (iii) injecting moulding material into the void, said moulding material being selected to provide a substantially rigid tube when cured;
- (iv) removing the female mould member from the male mould member while the tube is in a green state, the grooves in the male mould member retaining the tube in position on the male mould member; and
- 15 (v) subsequently forcing the tube from the male mould member while the tube is still in a green state.
2. A method according to claim 1 wherein the grooves are not uniformly spaced on the male mould member so that once the initial release of the tube from all of the grooves takes place, as the tube is progressively slid off the male mould member, the ribs do not all encounter grooves at the same time.
- 20 3. A method according to claim 1 or claim 2 wherein the tube shaped void includes a void forming a transverse base across one end of the tube at the free end of the male mould member, during production while the moulding material covers the free end of the male mould member, the inside of the base is vented through
- 25 the male mould member to avoid suction that may inhibit pushing of the tube off the male mould member.
4. A rigid injection moulded generally cylindrical canister, the canister having a side wall, the side wall having an outer surface and an inner surface, the canister being used as a filter element holding a paper roll as filter media, the canister
- 30 having a thin side wall and there being spaced anti-tracking ribs projecting from the inner surface of the side wall and projecting a distance sufficient to enable the

canister to be removed from the male mould member defining said ribs, the paper roll being of marginally greater diameter than the internal diameter of the canister, the canister being sufficiently rigid and the paper roll being sufficiently tightly wound that the paper roll, when inserted into the canister using a press, is substantially compressed to the internal dimension of the canister without distortion of the canister.

5

5. A rigid injection moulded canister according to claim 4 wherein the ribs project at 1 mm to 2 mm from the inner surface of the canister.

10

6. A rigid injection moulded canister according to claim 4 wherein the ribs project about 1.5 mm from the inner surface of the canister.

7. The canister according to claim 4 wherein the ribs are evenly spaced, the inner wall having slight taper on the inner surface to enable release from the male mould.

15

8. The canister according to claim 4 including a marginal taper on the inner surface at the open end to act as a lead-in for the paper roll.

9. The canister according to claim 4 including a base and wherein the base is inwardly biased.

20

10. The canister according to claim 4 including a base and wherein the base is inwardly dished at the centre relative to the edges in order to provide a bias against loading as a paper roll is being pressed into the canister.

25

11. The canister according to claim 4 including a base and wherein the base has an inner surface with radially extending flow passages separated by lands, the lands defining a supporting surface to evenly distribute and support the paper roll media across the base of the canister to provide secondary flow passages across the base of the canister.

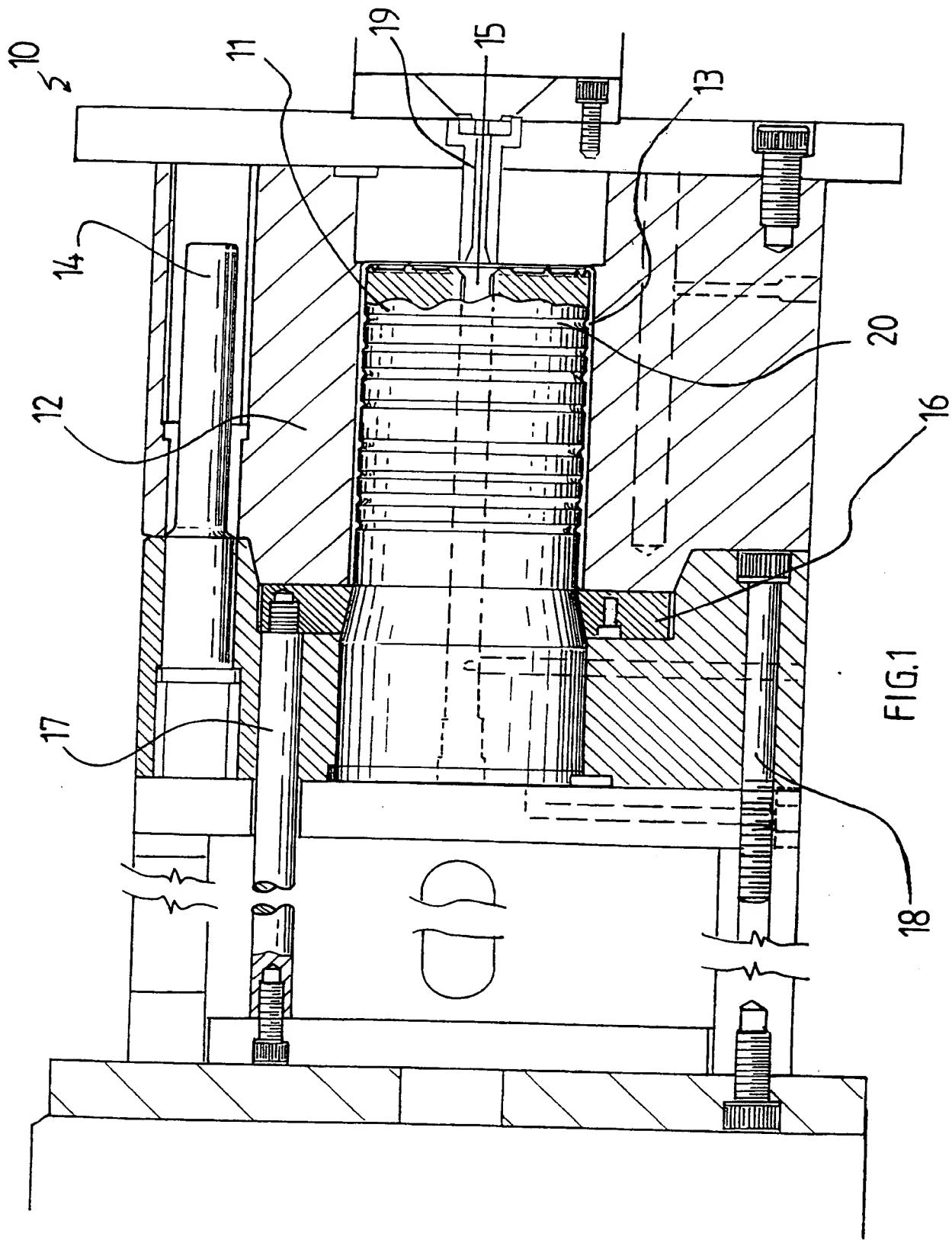
30

12. A filter element having a rigid injection moulded generally cylindrical canister, the canister having a side wall, the side wall having an outer surface and an inner surface, the canister holding a paper roll as filter media, the canister having a thin side wall and there being spaced anti-tracking ribs projecting from the inner surface of the side wall and projecting a distance sufficient to enable the canister to be removed from the male mould member defining said ribs, the paper roll being

of marginally greater diameter than the internal diameter of the canister, the canister being sufficiently rigid and the paper roll being sufficiently tightly wound that the paper roll, when inserted into the canister using a press, is substantially compressed to the internal dimension of the canister without distortion of the canister.

- 5 13. A filter element according to claim 12 wherein the ribs project at 1 mm to 2 mm from the inner surface of the canister.
14. A filter element according to claim 12 wherein the ribs project about 1.5 mm from the inner surface of the canister.
15. A filter element according to claim 12 wherein the ribs are evenly spaced,
10 the inner wall having slight taper on the inner surface to enable release from the male mould.
16. A filter element according to claim 12 including a marginal taper on the inner surface at the open end to act as a lead-in for the paper roll.
17. A filter element according to claim 12 including a base and wherein the
15 base is inwardly biased.
18. A filter element according to claim 12 including a base and wherein the base is inwardly dished at the centre relative to the edges in order to provide a bias against loading as a paper roll is being pressed into the canister.
19. A filter element according to claim 12 including a base and wherein the
20 base has an inner surface with radially extending flow passages separated by lands, the lands defining a supporting surface to evenly distribute and support the paper roll media across the base of the canister to provide secondary flow passages across the base of the canister.
20. A filter element according to claim 12 wherein the paper roll is wound to an
25 average density of about 13m/radial cm.
21. A filter element according to claim 12 wherein the paper roll is wound to an average density of no less than about 11m/radial cm and no more than about 15m/radial cm.
22. A filter element according to claim 12 wherein the paper roll is wound to an
30 average density of about 13m/radial cm.

23. A filter element according to claim 12 wherein the paper roll is wound to an average density of about 13m/radial cm and the paper thickness is about 17gsm.
24. A filter element according to claim 12 wherein the paper roll is wound to an average density of no less than about 11m/radial cm and no more than about 15m/radial cm and the paper thickness is about 17gsm.
- 5 25. A filter canister substantially as described with references to the accompanying drawings.



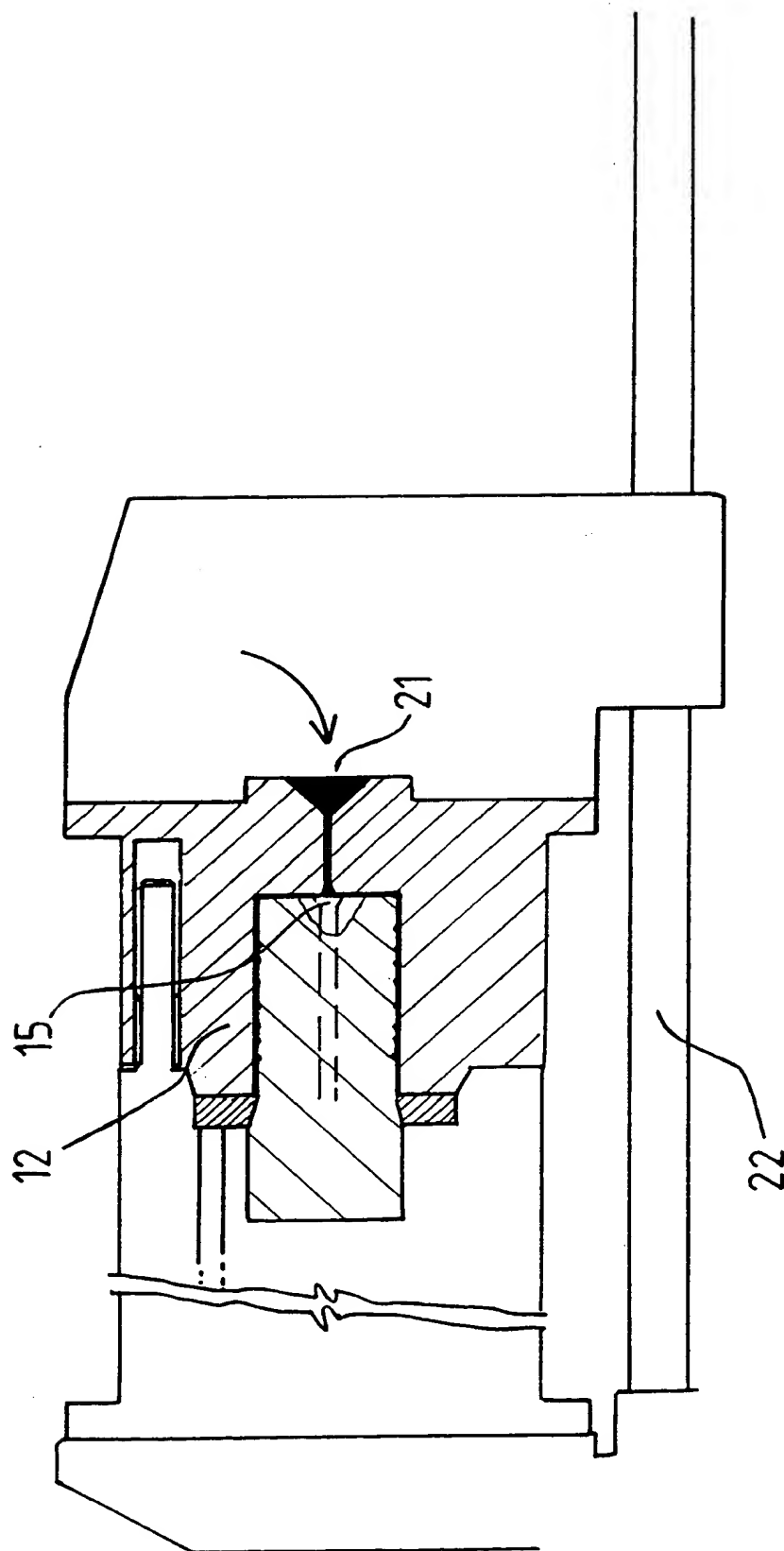


FIG. 2

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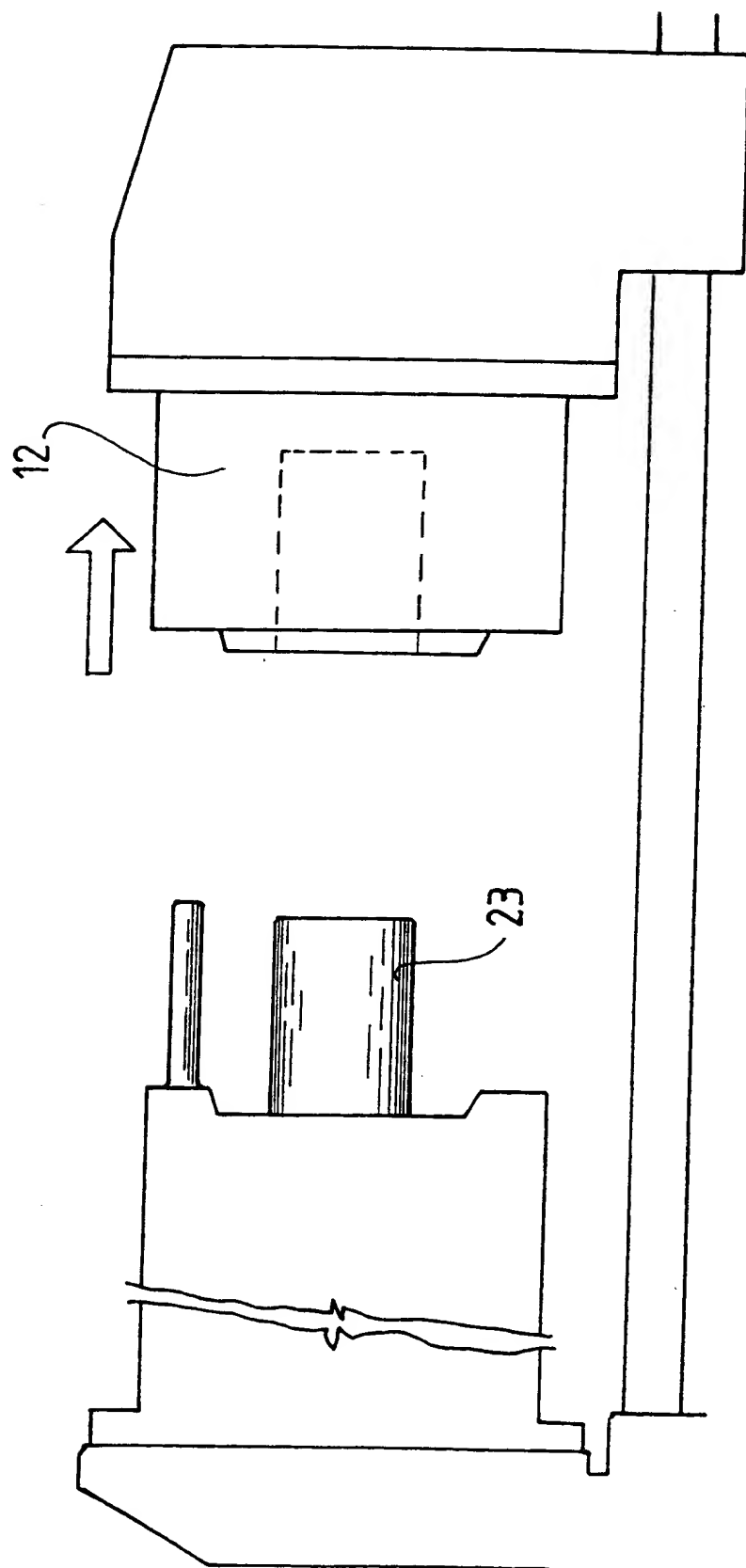


FIG. 3

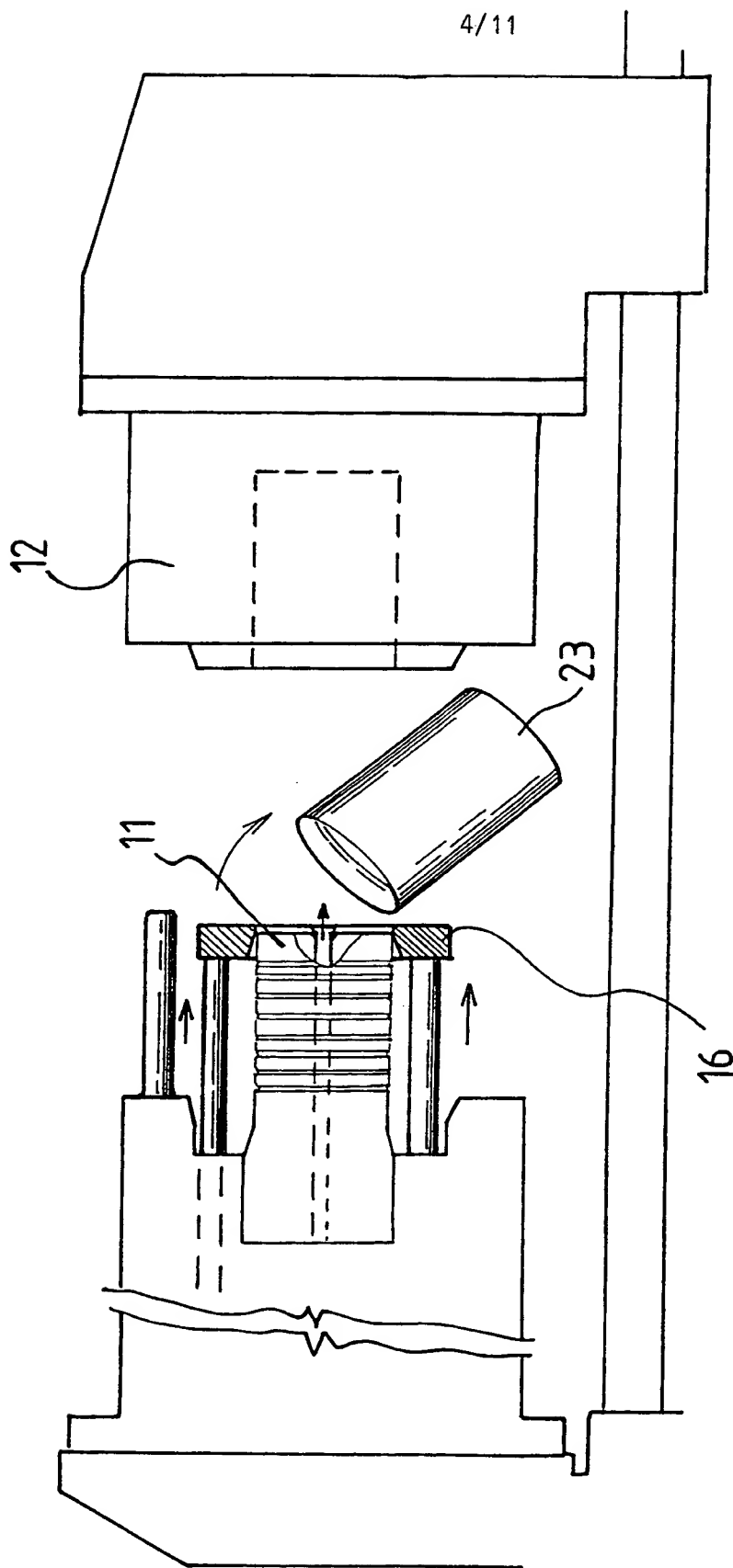


FIG. 4

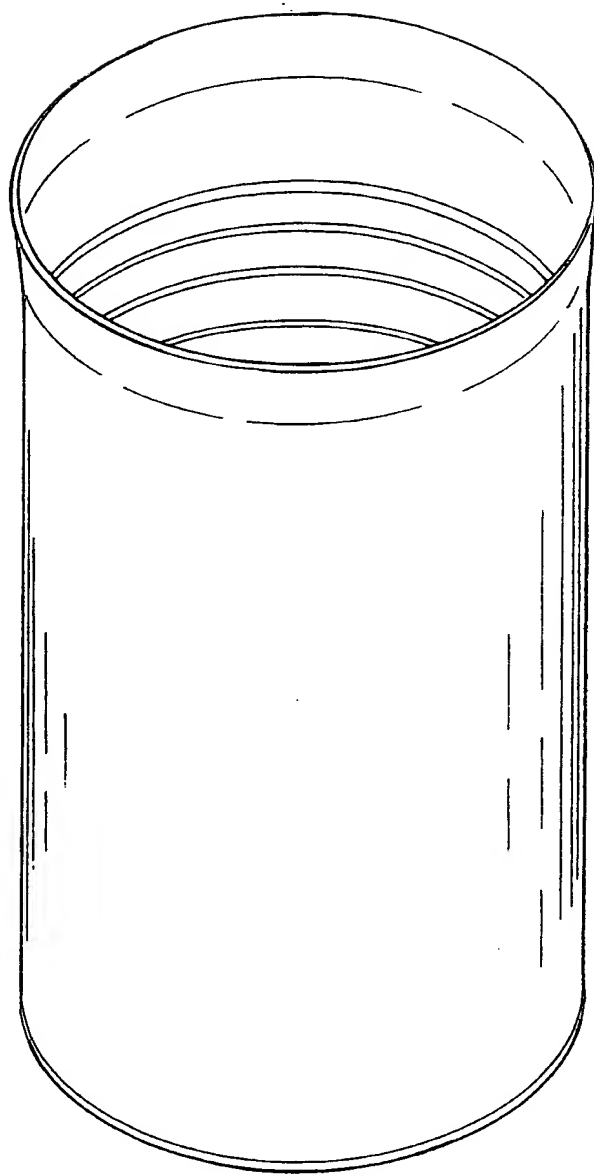


FIG. 5

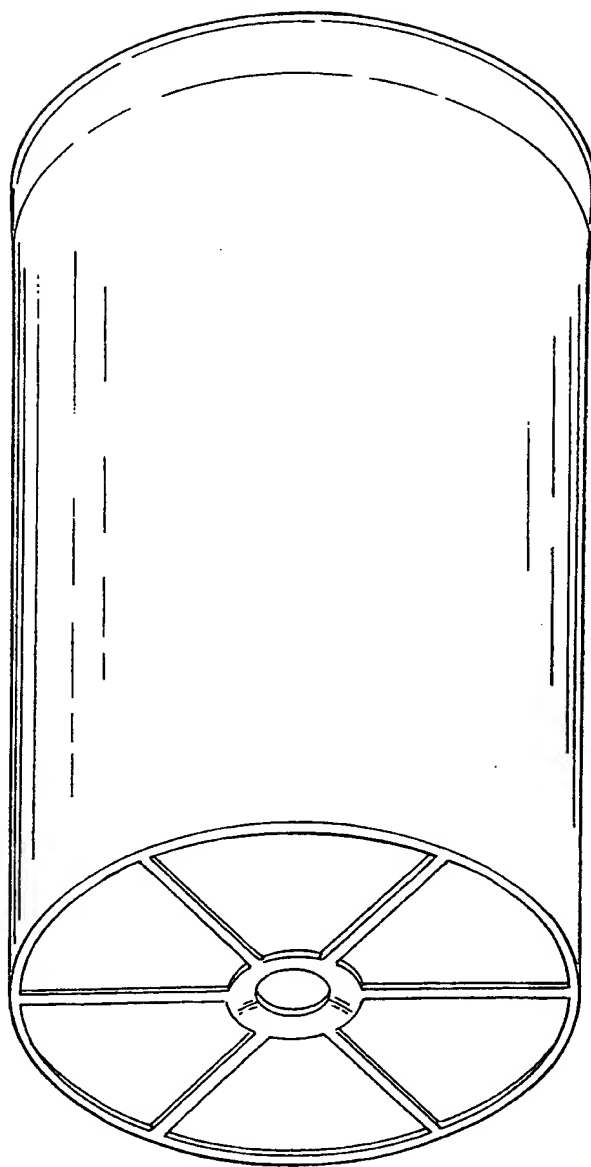


FIG. 6

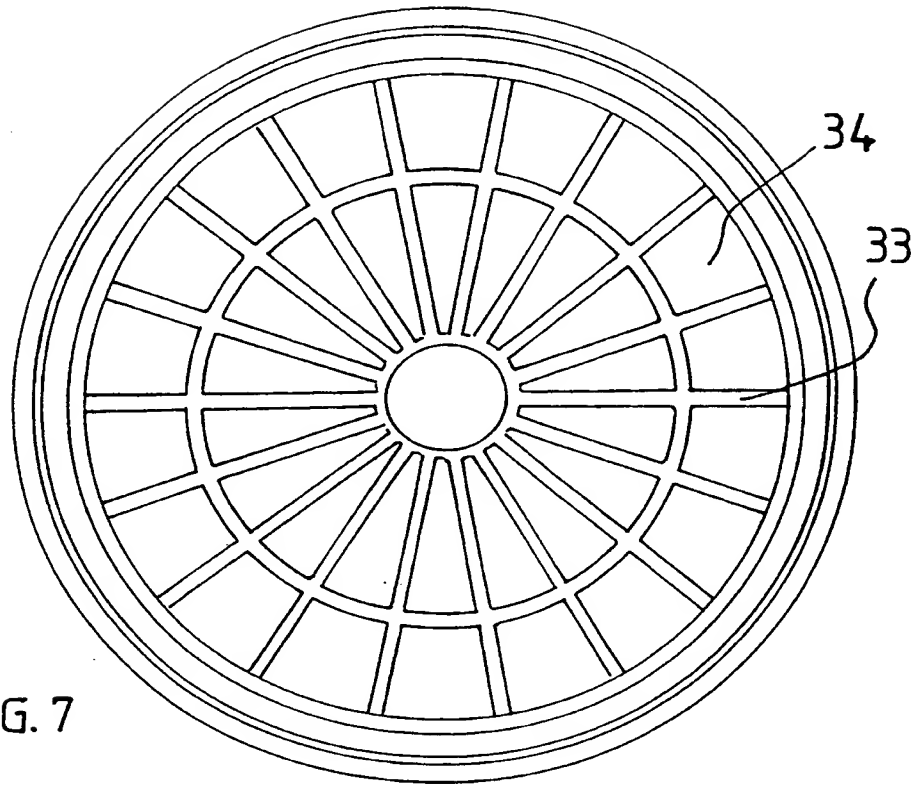


FIG. 7

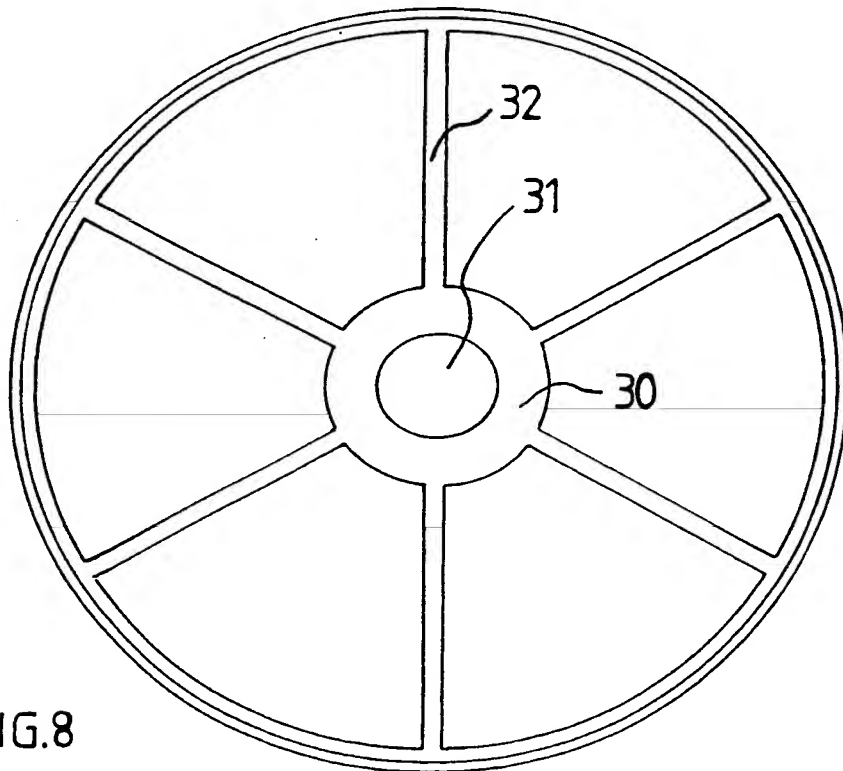


FIG. 8

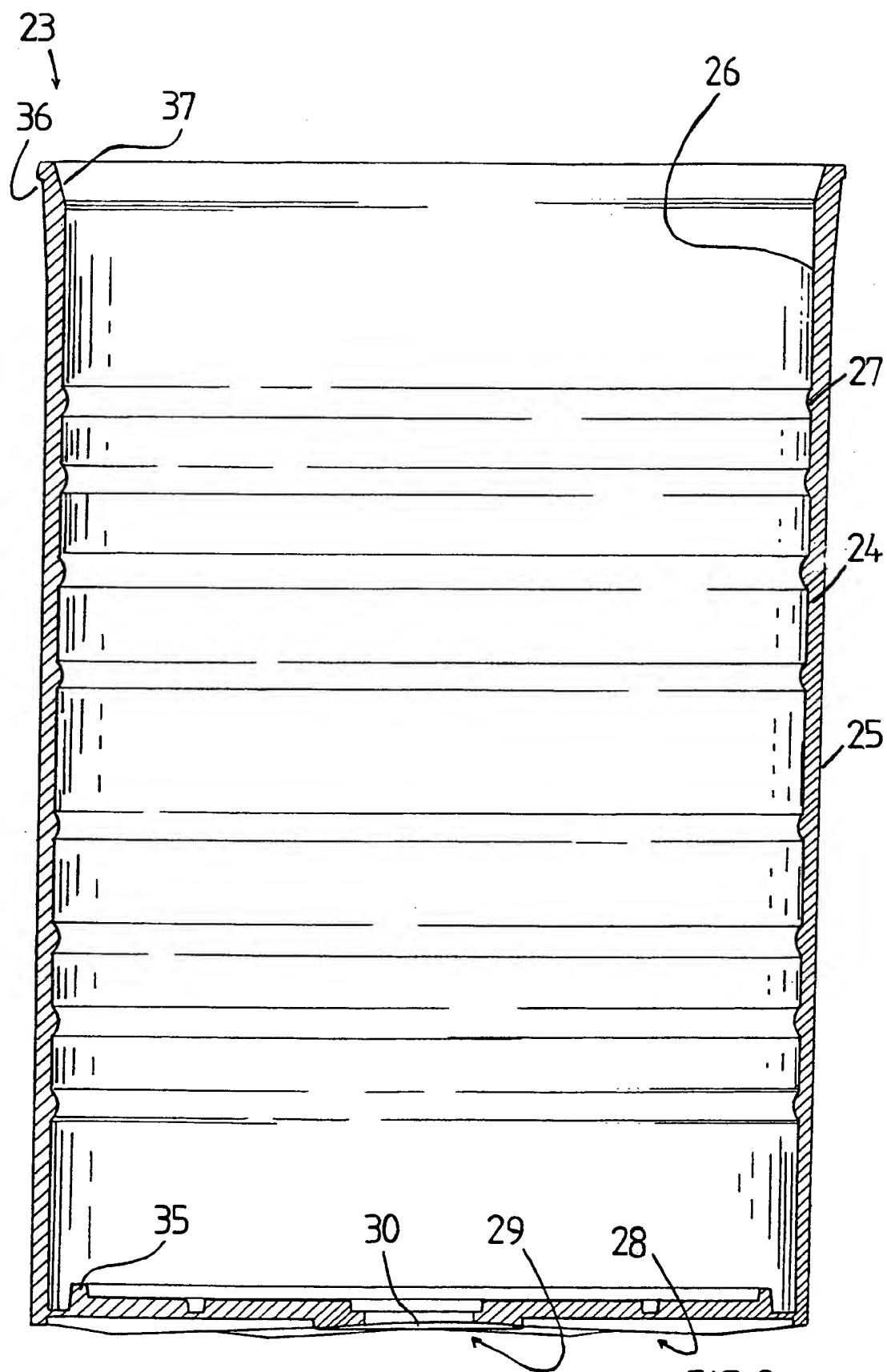
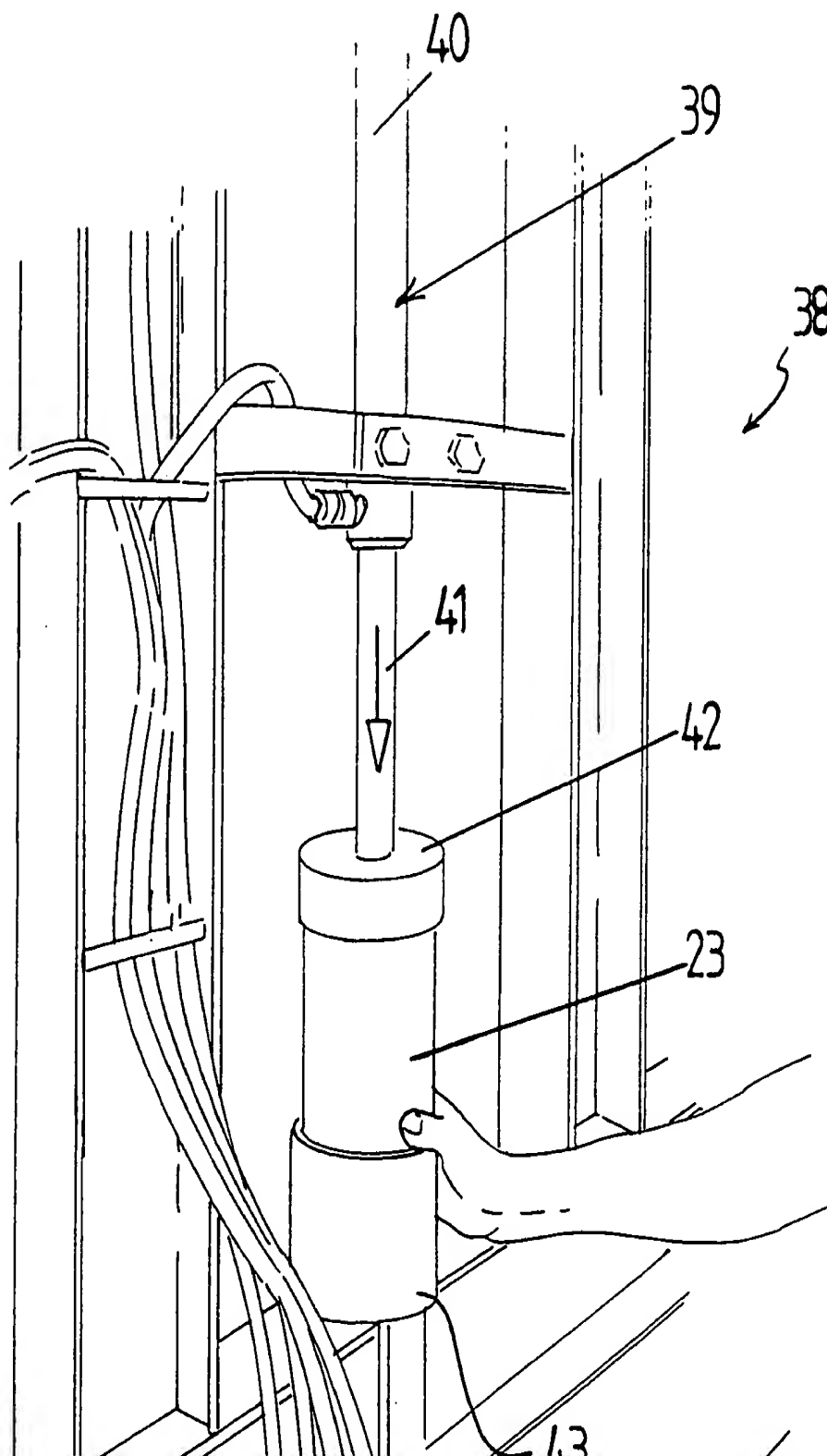
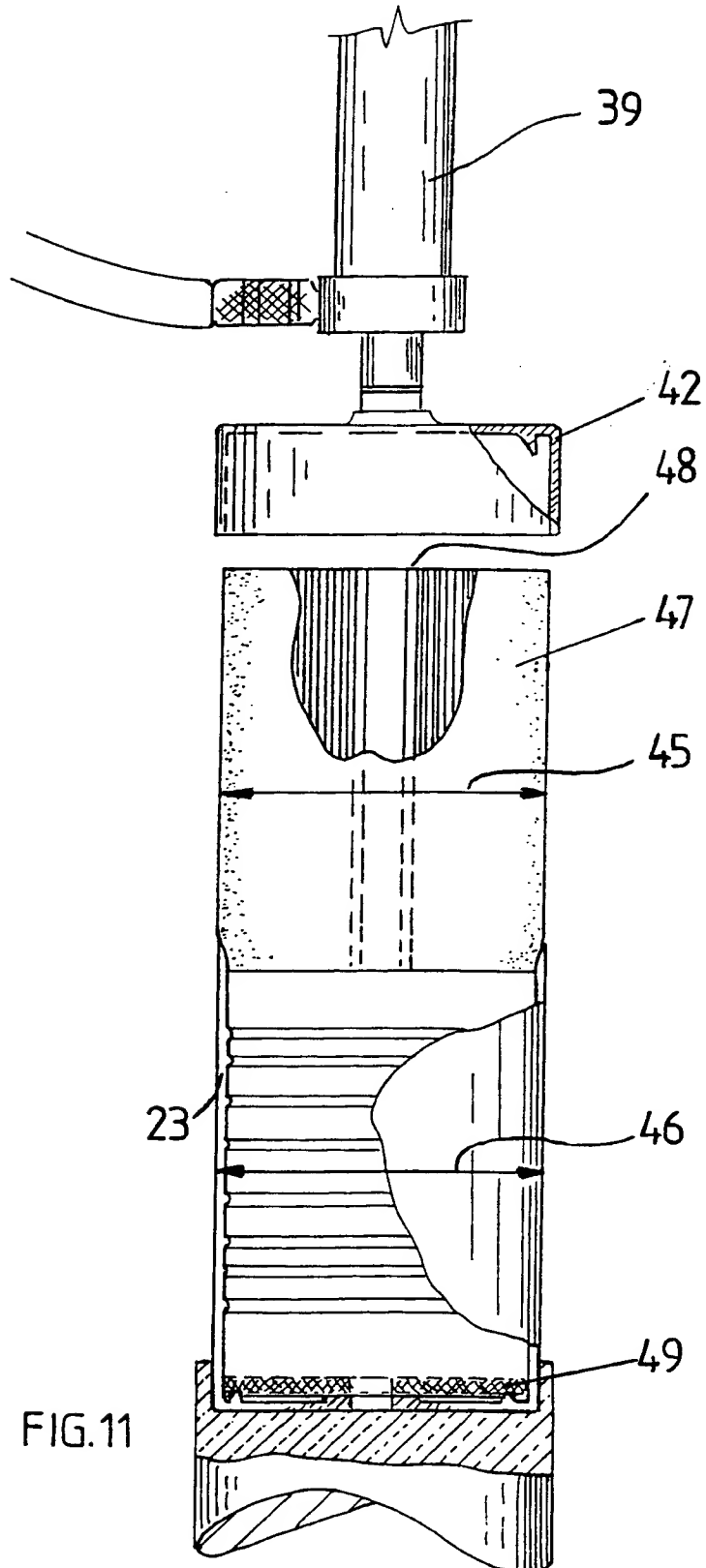


FIG. 9

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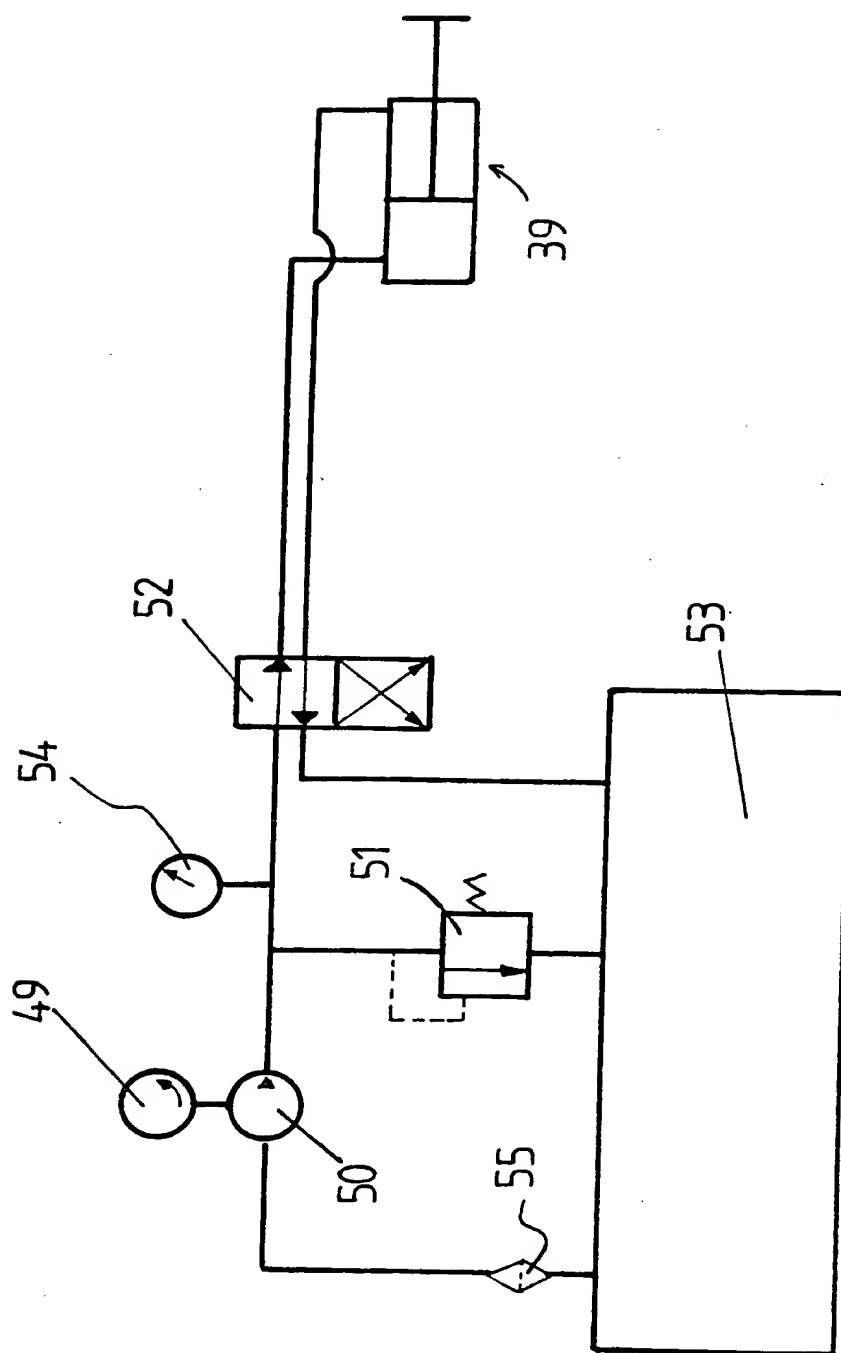


FIG.12

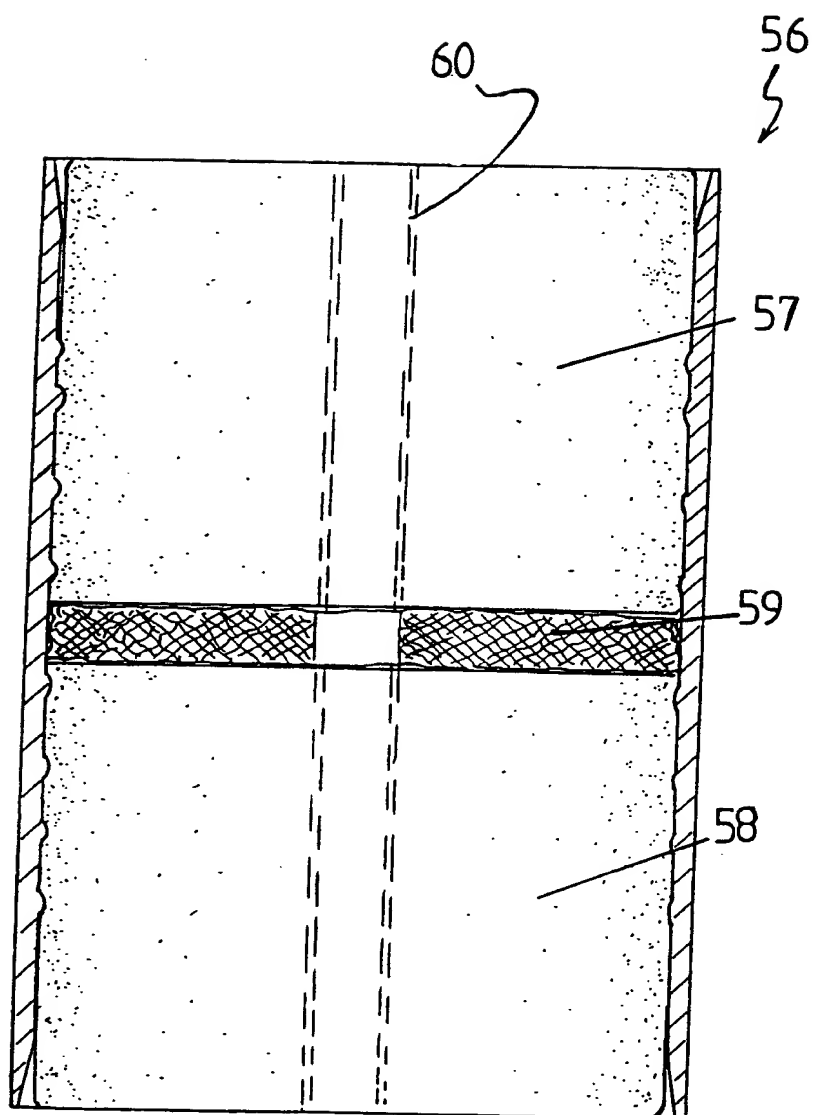


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU99/01121

A. CLASSIFICATION OF SUBJECT MATTERInt. Cl. ⁷: B29C 45/40; B01D 27/08, 35/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B29C 45/40; B01D 27/08, 35/30, 27/06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

AU: IPC B01D 27/08, 35/30

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPAT: Green+ OR +CURE+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AU 27314/92 (650176) B (FRANTZ FILTERS MARKETING PTY. LTD) 29 April 1993, see page 6 lines 9-16 and figures 1-3	4-10, 12-18, 21-25
X	WO 97 19737 A (FILTER TECHNOLOGY INTERNATIONAL PTY. LTD.) 5 June 1997, see pages 3-5 and figures 1-6	4-10, 12-18, 21-25
A	US 5 556 542 A (Berman, et al.) 17 September 1996	



Further documents are listed in the continuation of Box C



See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

24 March 2000

Date of mailing of the international search report

29 MAR 2000

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU99/01121

Box I Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos :
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos :
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos :
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See attached sheet.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU99/01121

Supplemental Box

(To be used when the space in any of Boxes I to VIII is not sufficient)

Continuation of Box No: II

The International application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept. In coming to this conclusion the International Searching Authority has found that there are two inventions:

1. Claims 1-3 are directed to a method of construction of internally ribbed injection moulded hollow tube section wherein, the steps of removing the female mould member from the male mould member, and then the removal of the tube from the male mould, both occur while the tube is in a green state. It is considered that the above integers comprise a first "special technical feature".
2. Claim 4-26 is directed to a rigid injection moulded generally cylindrical canister. It is considered that the above integers comprise a second "special technical feature".

Since the above-mentioned groups of claims do not share either technical features identified, a "technical relationship" between the inventions, as defined in PCT Rule 13.2 does not exist. Accordingly the International application does not relate to one invention as a single inventive concept.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU99/01121

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
AU	27314/92	GB	2260713				
WO	9719737	AU	76855/96	BR	9611794	CN	1202837
		EP	876185	AU	48824/99		
US	5556542	AU	80117/94	BR	9407616	EP	721364
		WO	9509037	US	5549821	AU	26043/95
		WO	9532786				

END OF ANNEX